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Perbunan and Its Use—I

Characteristics and Processing Technique . . . .

C. A. Klebsattel [1]

THIS is the first of a series of articles which will present in condensed form the results of the development and research carried on during the past two years by Advance Solvents & Chemicals Corp. in connection with the sale and use in the United States of Perbunan produced in Germany. These articles constitute the first publication of factual information and graphical data obtained through compounding experience in this country on the German-made material.

Part I, in this issue, discusses the inherent properties of Perbunan and the proper methods of plasticizing the raw material and of incorporating various compounding ingredients into the mix. Part II will deal with the function and effects of various types of compounding ingredients. Part III will concern itself with the fabrication of compounded Perbunan stocks and their formulation for certain specific purposes.

After many years of technical cooperation with I. G. Farbenindustrie, the originator of the Buna synthetic rubbers, arrangements have been made whereby the Standard Oil Development Co., through the exchange of patents, has taken over the entire Buna rubber development for the United States. In addition to building a plant for the manufacture of this material the Standard Oil Development Co. has issued a license for manufacture and use to the Firestone Tire & Rubber Co. As a result of this projected production there is certain to be an increasing desire for knowledge of Perbunan and its usage.

EDITOR'S NOTE.

IN ADDITION to a high resistance to the swelling action of a wide range of solvents, Perbunan, a synthetic rubber-like material, possesses many superior and very valuable physical properties. The specific gravity of Perbunan is 0.96; the weight of a given volume of Perbunan is not greatly different from that of natural rubber, whereas with the one exception of Vistanex, other synthetic, rubbery materials are much higher.

Inherent Properties

A brief outline of these characteristics follows:

Processing Qualities

Perbunan is milled and broken down in much the same manner as natural rubber; it requires sulphur, accelerators, etc., for vulcanization, as does natural rubber. Perbunan can be extruded and calendered on regular rubber working machinery. It can be prepared so as to produce compounds varying from extremely resilient, soft products through a stiff, leathery composition and on to the equivalent of hard rubber. Just as great latitude in curing times and temperatures is possible with Perbunan as with natural rubber. Therefore Perbunan presents little difficulty to an experienced rubber technologist.

Tensile Strength, Hardness, and Elasticity

Properly compounded, Perbunan can be vulcanized to give finished products comparable with natural rubber for all practical purposes in these respects. Perbunan is reenforced most effectively with carbon black, as it does not develop maximum physical strength in the form of pure gum compounds or in the presence of the majority of white or inert fillers.

Aging Characteristics

The aging rate of compounded Perbunan is much slower than that of natural rubber; consequently it retains its elasticity and flexibility exceptionally well. For many applications Perbunan will give several times the service life that can be expected of natural rubber. Perbunan does not soften or develop tackiness as it ages.

Abrasion Resistance

Natural rubber has as one of its most outstandingly useful properties very good resistance to abrasion. Perbunan is at least as resistant to abrasion as natural rubber under normal circumstances, and in the presence of lubricating oils and other swelling agents it is vastly superior to natural rubber.

[1] Chief chemist, Advance Solvents & Chemicals Corp., New York, N. Y.

Swelling in Solvents

The swelling action in solvents is in general far less than is the case with vulcanized natural rubber compounds. The resistance of Perbunan to swelling in all petroleum distillates, vegetable oils, alcohols, and numerous other organic solvents is particularly good. In contact with such solvents, even under extreme conditions and for extended periods of time, Perbunan retains a large measure of its original tensile strength and other physical properties.

Certain solvents, such as the aromatic hydrocarbons, chlorinated hydrocarbons, ketones, some esters, and amines, have a swelling action on vulcanized Perbunan. A very brief summary in table form showing typical swelling data of a specimen Perbunan compound tested with various solvents follows:

SWELLING OF AN UNPLASTICIZED PERBUNAN COMPOUND INITIAL TENSILE STRENGTH: 2,600 POUNDS PER SQUARE INCH TEST PERIOD: EIGHT WEEKS AT ROOM TEMPERATURE

Solvent	% Increase in Weight	Tensile Strength Lbs. Sq. In. Swelled Sample
Petroleum Fraction		
Propane, butane, gasoline, vaseline, mineral spirits, lubricating oil	0- 10%	2,100-2,500
Transformer oil	0- 10%	2,400
Fuel oil	0- 10%	2,300
Paraffin oil	0- 10%	1,850
Aromatics		
Benzol, toluol, xylol, tetralin	50-100% or more	700
Chlorinated Hydrocarbons		
Carbon tetrachloride	50-100% or more	850
Methylene chloride, Chlorbenzol	100% or more	400- 700
Alcohols		
Methyl, ethyl, butyl alcohols	0-10-20%	1,700-1,850
Glycol, glycerol	0- 10%	2,400-2,500
Esters, Ketones, Aldehydes, Aromatic		
Amines	50-100% or more	400- 600
Fats		
Palm oil, fish oil, butter	0- 20%	2,100-2,500
Linseed oil	10- 20%	1,950
Oleic acid	20- 50%	2,500

Hydrocarbon Gas Permeability

Perbunan is particularly good in its impermeability to aliphatic hydrocarbon gases. Included in this class are propane, butane, etc.

Permanent Set and Creep

Natural rubber and its synthetic substitutes take an immediate permanent set or are lastingly deformed by a load applied either in tension or compression. In addition, rubber, and more particularly many synthetic substitutes, show the phenomenon called "creep," which is defined as continued, slow, plastic flow under load, beyond the initial permanent set. This "creep" is a serious obstacle to such applications as gaskets and packings or vibration absorbing mountings. Perbunan takes only a small permanent set under load, and the phenomenon of "creep" or continued flow is practically absent.

Heat Resistance

Natural rubber is unsatisfactory for continued service at above 200° F. where it rapidly loses its original properties, either becoming soft and sticky or hardening until it loses elasticity. Perbunan, properly compounded, will operate for extended periods at much higher temperatures than natural rubber can stand. Slow hardening occurs, but no tackiness develops.

Hysteresis Loss

Natural rubber and all its substitutes absorb a portion of the mechanical energy expended in deforming them. This energy is converted to heat which raises the temperature of the rubber as it is mechanically deformed. This loss of energy in the form of heat developed internally is low with Perbunan and is comparable to the values of the best rubber compound. Furthermore the heat conductivity of Perbunan is about 20% better than that of natural rubber; consequently the temperature rise in a constantly flexed Perbunan article will be less than in a corresponding natural rubber compound.

Ozone Resistance and Sun Checking

These properties found in Perbunan are superior to those of natural rubber. This is especially true of compounds formulated with such specific service in mind.

Electrical Properties

The electrical insulation value of Perbunan is not outstanding. Its specific resistance is of the order of 10^7—10^9 ohms per cm^2. In wire insulation Perbunan is best applied as a sheath or jacket cover where its abrasion resistance, good aging characteristics, and oil resistance are beneficial. In case a semi-conducting cable sheath is desired such a compound is possible through the incorporation of special types of graphite and carbon black as fillers.

Typical Applications

A few of the more obvious uses for Perbunan are as follows:

Oil Resistant Mechanical Rubber Goods, such as:
- Gasoline and Oil Hose,
- Air and Steam Hose,
- Power Transmission Belting,
- Conveyer Belts,
- Motor and Machine Mountings,
- Vibration Absorbing Mountings,
- Gaskets and Packings of All Sorts,
- Diaphragms and Bellows,
- Hard or Soft Tank Lining Compounds,
- Packing Rings and Hose for foodstuff and dairy product handling.

Oil and Abrasion Resistant Wire, Hose or Belt Sheathing.
Oil Resistant Gloves, Aprons, Shoes, and Other Clothing.
Printing Rolls, Plates, and Blankets.
Oil-Resistant Artificial Leather or Other Coated Fabrics.
Solvent Resistant Bristle Mountings for brush manufacture.
Cements and Dipping or Spreading Compounds for every sort of application where oil and heat resistance are requisite.

Milling and Mixing Procedure

The proper compounding of Perbunan is very closely comparable to the handling of natural crude rubber. The steps involved in compounding any normal Perbunan formula are outlined in sequence as follows.

Mastication or Breakdown

As the first step in processing Perbunan, proper breakdown is absolutely essential. Owing to the reduced thermo-plasticity of Perbunan as compared to natural rubber, certain precautions are necessary. The breakdown must be done on a regular two-roll rubber mill. It has not been found possible to break down or properly masticate Perbunan in an internal mixer of the Banbury type, although the Banbury is usable for further compounding once the Perbunan is broken down on the rolls.

To break down Perbunan properly on the rubber mill the rolls must be tightly set and very thoroughly cooled. More heat is developed in masticating crude Perbunan than in milling crude rubber. If the mill is not sufficiently cooled to conduct away this heat, the temperature of the mass will rise, and the breakdown period will be prolonged. It is advisable that the milling be done so that the temperature of the mass does not rise above 70° C. This can be regulated by the cooling water through the rolls, adjusting the batch size, or, finally, by spraying on to the batch on the mill a little water, the evaporation of which will reduce the temperature of the mass.

A roll speed ratio of 1.0 to 1.15 gives a most rapid breakdown of crude Perbunan, but any regular rubber mill available will usually give satisfactory service provided the rolls are well cooled. Good practice is to use a smaller amount of crude Perbunan on the rolls than in the case of natural rubber. For example, on a 12-inch laboratory mill one should work with not over one pound of crude Perbunan. On a 60-inch mill the batch of crude Perbunan should not be greater than 30 or 35 pounds. With the above amounts of Perbunan on a tightly set, thoroughly cooled mill, the proper breakdown should be accomplished in 20 to 25 minutes.

The recognition of proper degree of breakdown of Perbunan is not so easy as with natural rubber since Perbunan does not become so plastic or tacky. An effective test for proper breakdown can be made by sheeting the milled Perbunan to paper thinness and then rupturing the sheet by forcing the finger tip through it. Properly broken-down Perbunan tested in this manner will rupture by pulling out easily in strings or threads, rather than by tearing sharply and cleanly as in the case of incomplete breakdown.

Particular care must be taken so as to insure proper mastication of the crude Perbunan before proceeding with further compounding. The conditions under which it is obtainable must be determined in each individual case. The necessity for thoroughness in this operation cannot be over-emphasized as a proper initial breakdown is necessary to obtain:

1. Dispersing ability for fillers, etc.
2. Good flow of the compound in molding.
3. Maximum elongation of the vulcanized compound.
4. Maximum tensile strength.
5. Maximum resilience.
6. Solubility in solvents in case cements are to be made.

Addition of Softeners

The second step in compounding Perbunan is to mill into the properly broken-down crude material any plasticizers or softeners included in the batch ticket. Any normal amount of plasticizer up to 20% on the Perbunan may be added completely at this stage. Any resinous softeners should preferably be milled together with compatible liquid softeners before milling them in. This will assure a more homogeneous mix. In case the compound calls for a large amount of softener, it is advisable to mill in only a portion at this stage, holding out the remainder to be milled in along with the carbon black or fillers. Those softeners which are taken up with difficulty by Perbunan may also be added in small portions during the incorporation of the black at a later stage. These latter softeners include Degras, stearic acid, semi-fluid Factice, and paraffin wax.

If the compound calls for more than 20% of softener on the Perbunan, only 20% should be put into the mix at this stage, and the balance should be incorporated along with the blacks and other fillers at the fourth stage. Likewise, it is best to add along with the blacks and fillers any stearic acid, paraffin wax, and other materials which do not incorporate readily into the Perbunan in the absence of fillers.

Addition of Sulphur and Zinc Oxide

The third step in normal Perbunan compounding is to mill into the masticated and plasticized Perbunan any sulphur and zinc oxide called for by the formula. These are not too readily wetted by Perbunan and are added at this stage slowly and carefully to insure that the small quantities used will be thoroughly dispersed.

Addition of Fillers

The fourth step is to incorporate the carbon blacks or other fillers. These should not be added to the Perbunan on the mill so rapidly as is possible with natural rubber. Channel blacks, in particular, must be added slowly and carefully so as to insure proper dispersion at this stage. If they are not properly dispersed at this point, it will be necessary to remill the stock carefully, which will take much more time than if it is accomplished at the initial stage. If two or more semi-reenforcing blacks or other soft fillers are used in the same compound, it is often desirable either to mix them before incorporation or to add small quantities of each alternately.

Addition of Accelerators

The fifth step in Perbunan compounding should be the addition of the accelerators. These should also be very carefully milled in to secure good dispersion. It is well to set the mill rolls tight and refine the batch by several passes through the mill, pulling the thinly sheeted material off, rolling it up, and charging it back to the mill repeatedly. Whenever possible, it is good practice to allow the compounded batch of Perbunan to stand for a day, then refine it by a few passes through a tight, cool mill before further fabricating it. This storing and refining will in many cases result in a stock with as high as a 10% increase in tensile, etc., over the same compound vulcanized immediately after milling.

(*To be continued*)

Amberex Type B Factice

A new factice, Amberex Type B, is now being produced by The Stamford Rubber Supply Co., Stamford, Conn. Amberex Type B is a yellowish white, low-gravity vulcanized oil, said to be unusually soluble in rubber and specially adapted for use in transparent rubber stocks; in white, heater-cured goods that are calendered or extruded; and in sponge rubber of light pastel shades. The new factice has less than 0.5% ash, less than 15% acetone extract, and less than 2.5% free sulphur. As it is free from chlorine, Type B is said to be suitable for use with organic accelerators.

The Standardization of Rubber Flexing Tests

W. L. Stevens[1]

THE present paper offers a method for standardizing rubber breakdown tests, which is an adaptation of discriminant function analysis recently developed by R. A. Fisher, and hitherto applied only to the treatment of biological data.

The data which form the subject of the present study are rather inadequate, but it is worth while to use them in order to make the method available for more extensive investigations at a later date. It has, at least, revealed a gross lack of control in the experimental technique and shows that great improvements must be made on the practical side to give the new statistical method a chance to show its real sensitivity.

1. Tests and Data[2]

Samples of ten different kinds of rubber were "bend-flexed" by a De Mattia machine. At suitable intervals the machine was stopped, and the state of breakdown of the rubber rated qualitatively by comparison with a series of pieces showing successive stages of breakdown. The whole was repeated with a second sample of each of the ten kinds. Originally there were ten qualitative scores, but an inspection of the data (Table 1) showed that there was no point in discriminating between the advanced stages of disintegration at which different samples were able to hang on indefinitely, as for example Nos. 4 and 5 at K and No. 9 at H. These represent such extreme stages of breakdown (the rubber being broken through the middle) that, both for practical and statistical reasons, the test should be regarded as definitely finished as if the rubber had broken completely in half.

TABLE 1. DATA FOR 20 FLEXING TESTS ON RUBBER

First Test										Total Number of Flexings	Second Test									
1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	6	7	8	9	10
							B			4,500								B		
			A	A			C			9,000								B		
		A	A	A			C			13,500					B		A	C		
		A	D	C		B	C			22,500			A	B	F		C	C		A
		C	F	E		C	C			31,500	A	A	B	C	H	A	D	D		B
		C	H	G		D	C			40,500	A	A	C	D	K	B	E	D		C
		D	H	G		E	D			49,500	B	B	C	E	K	B	F	D	A	D
		D	H	H		F	D		B	58,500	C	C	D	H	K	D	G	D	B	E
A	B	D	H	J	A	G	D		B	67,500	C	D	D	J	K	E	G	D	C	E
B	B	E	K	K	B	G	G	A	B	85,500	C	D	E	K	K	F	G	D	F	E
C	C	F	K	K	D	H	G	B	B	103,500	C	E	F	K	K	F	H	D	G	G
C	D	G	K	K	E	H	G	B	B	121,500	C	F	H	K	K	H	H	E	G	*G*
C	D	G	K	K	F	H	G	B	B	139,500	D	G	J	K	K	J	H	H	G	
C	D	G	K	K	G	J	J	D	C	157,500	E	H	K	K	K	J	H	H	H	
D	D	H	K	K	G	J	J	E	H	175,500	E	H	K	K	K	J	H	J	H	
D	E	H	K	K	G	J	J	F	H	193,500	F	J	K	K	K	K	H	J	H	
E	F	H	K	K	H	J	J	G	H	211,500	G	K	K	K	K	K	J	J	J	
E	F	H	K	K	H	K	J	H	*H*	229,500	G	K	K	K	K	K	J	*J*	J	
E	G	H	K	K	H	K	J	H		247,500	G	K	K	K	K	K	K		J	
F	G	H	K	K	H	*K*	*J*	H		265,500	G	K	K	K	K	K	K		J	
F	G	H	K	K	J			H		283,500	G	K	K	K	K	K	K		J	
G	G	H	K	K	J			H		306,000	G	K	K	K	K	K	K		J	
G	G	H	K	K	J			H		324,000	H	K	K	K	K	K	K		J	
G	G	H	K	K	K			H		360,000	J	K	K	K	K	K	K		J	
G	G	H	K	K	K			H		400,000	J	K	K	K	K	K	K		J	

The progressive deterioration scores are denoted by letters A to K, with I excluded. Italic letters denote complete rupture of test piece.

[1] Galton Laboratory, University College, London, England.
[2] The data used to illustrate the statistical methods were kindly placed at my disposal by Dr. R. G. Newton, who is also my informant on matters of laboratory technique.

We therefore decided that the relevant data should be the more moderate stages of breakdown represented by the first five letters, A – E, although possibly F and G could also have been included.

The first attempt to apply the methods explained below also showed that rubber 8 was very anomalous and, if included, would necessitate much elaboration of the statistical method and destroy the simplicity of the results. It is, of course, obvious from the qualitative data that 8 on both occasions was very weak since it had already reached stage B at the first observation. Since this was only a preliminary investigation, we felt justified in discarding the two tests on No. 8 from our data. It is very likely that the comparatively simple method which is then possible will be adequate for comparison of all rubbers which are not too widely different in flexing resistance, i.e., for all comparisons which one would want to undertake in practice.

Alternatively, if the assumptions made do prove to be inadequate, the statistical method can, without great difficulty be elaborated to deal with a more complex situation.

2. Scaling the Number of Flexings

On looking at the original data we see that in different rubbers the progress of breakdown differs in at least two respects. Firstly, the initial (or the mean) breakdown point may be early or late; secondly, the time taken to pass from the initial stage A to the "final" stage E may be short or long. On the face of it, it seems that two parameters (at least) would be required to specify the behavior of the rubber. This may indeed be theoretically necessary, but any device which would in practice specify the flexing resistance of the rubber by a single parameter, without doing violence to the data, would be extremely welcome.

Noting, for example, that in the first set of tests, No. 1 begins (A) at 67,500 and finishes (E) at 247,500, while No. 5 takes from 9,000 to 31,500 for the same process, we are led to the idea of transforming the scale of number of flexings to a scale of logarithms. This device would suggest itself even more forcibly to those who know

TABLE 2. QUALITATIVE DATA AND MARGINAL TOTALS

	First Test									Second Test									x Logarithm of Number of Flexings	Subtotals					
	1	2	3	4	5	6	7	9	10	1	2	3	4	5	6	7	9	10		A	B	C	D	E	
																			0.653						
				A	A														0.954	2					2
			A	A	A									B		A			1.130	4	1				5
			A	D	C		B					A	B			C		A	1.352	3	2	2	1		8
			C		E		C			A	A	B	C		A	D		B	1.498	3	2	3	1	1	10
			C				D			A	A	C	D		B	E		C	1.607	2	1	3	2	1	9
			D				E			B	B	C	E		B		A	D	1.695	1	3	1	2	2	9
			D						B	C	C	D			D		B	E	1.767		2	2	3	1	8
	A	B	D			A			B	C	D	D			E		C	E	1.829	2	2	2	3	2	11
	B	B	E			B		A	B	C	D	E						E	1.932	1	4	1	1	3	10
	C	C				D		B	B	C	E								2.015		2	3	1	1	7
	C	D				E		[illegible]	[illegible]	C									2.084		2	2	1	1	6
	C	D						B	B	D									2.145		2	1	2		5
	C	D						D	C	E									2.197			2	2	1	5
	D	D						E		E									2.244				2	2	4
	D	E																	2.287				1	1	2
	E																		2.325					1	1
	E																		2.361					1	1
	E																		2.394					1	1
A	1		2	2	2	1		1		2	2	1			1	1	1	1		18					
B	1	2				1	1	3	6	1	1	1	1	1	2		1	1			23				
C	4	1	2		1		1		1	5	1	2	1			1	1	1				22			
D	2	4	3	1		1	1	1		1	2	2	1		1	1		1					22		
E	3	1	1		1	1	1	1		2	1	1	1		1	1		3						19	
	11	8	8	3	4	4	4	6	7	11	7	7	4	1	5	4	3	7							104

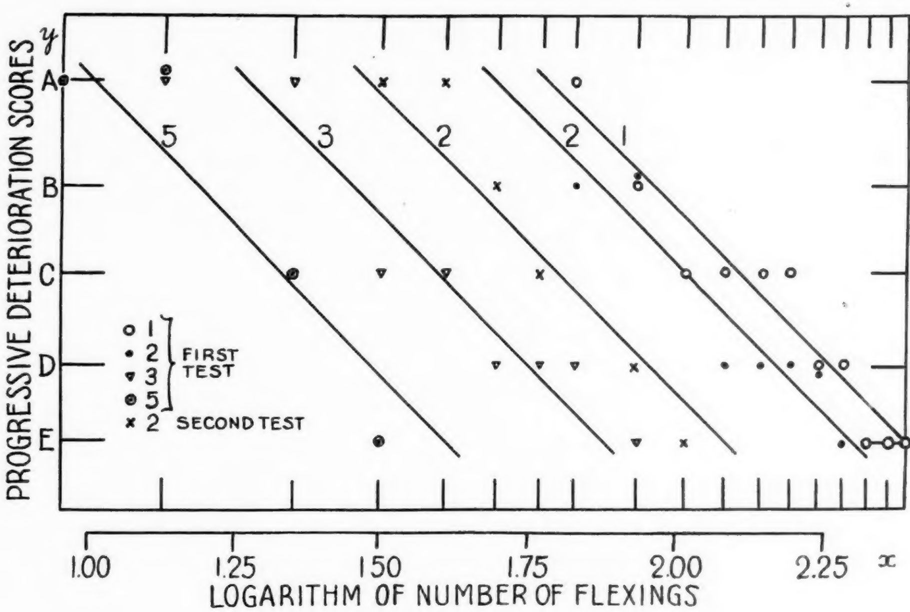

Fig. 1. Regressions of Scores on Logarithmic Flexings

the success of the same method in other fields; for example, in toxicology, where poison strengths, for statistical purposes, should usually be measured in logarithms, and in physiology where responses are in arithmetic progression, to stimuli which are in geometrical progression.

We therefore took as our measure of the treatment to which the test piece had been subjected the common logarithm of the number of flexings ÷ 1000 as is shown in Table 2. After this had been done, it was, of course, necessary to test the truth of this assumption. If the transformation is successful, we expect to find that the test pieces continue to differ from each other in their mean breakdown points but no longer differ in their rates of breakdown.

3. Scoring the Qualitative Observations

3.1. Except for the fact that the letters represent successive stages of breakdown, we have absolutely no *a priori* idea of how these letters stand on a quantitative scale. For example, is the "distance" between A and B more or less than the "distance" between D and E? The answer is that the data themselves must determine the quantitative scores. Since the treatment is measured by log flexings, it is clear that the letters should be so scored that the state of breakdown is linearly related to log flexings. Moreover, since we have assumed that on the log scale the rates of breakdown are the same for all tests, we must so allocate the scores to give minimum deviation from a set of regression lines, which have a common slope for all tests, but different positions for different tests. (See Figure 1.) We notice that these considerations lead only to a determination of the relative scores for A – E; we may afterward change them either by adding a constant to all, or by multiplying them by a constant.

3.2. Statistical Determination of the Scores

In the mathematical treatment we denote the quantitative scores in general by y and in particular by the same letters as were used for the qualitative grading.

Then the total variation of the scores is measured by the total sum of squares of deviations of the scores y from the general mean, i.e.,

$$S(y-\bar{y})^2$$

Since y takes one of the five yet undetermined values A, . . . E, this sum of squares is a homogeneous quadratic expression in A, . . . E. The expression may conveniently be represented by the symmetrical matrix of coefficients

$$\{T\} = \left\{ \begin{array}{ccccc} t_{AA} & t_{AB} & t_{AC} & t_{AD} & t_{AE} \\ & t_{BB} & t_{BC} & t_{BD} & t_{BE} \\ & & t_{CC} & t_{CD} & t_{CE} \\ & & & t_{DD} & t_{DE} \\ & & & & t_{EE} \end{array} \right\}$$

where t_{AA} is the coefficient of A^2 and t_{AB} that of 2 AB. The obvious big differences between the same rubber on two occasions leads us to treat all 18 tests as though they had different means so that the total sum of squares may be partitioned into the sum of the squares between tests and the sum of the squares within tests. The same analysis is made on the products of y and x(= log flexings,) and on squares of x. The former is in terms of linear functions of A, . . . E, conveniently represented by the coefficients in order; while the latter is, of course, the usual analysis of variance expressed by simple numbers.

The process is made clear by the actual arithmetic rather than by mathematical formulae.

The sum of squares within tests is

$$Sy^2 - \Sigma(Y_r\bar{y}_r)$$

where S denotes summation over the whole data, Y_r $\bar{y}_r$ are the subtotal and mean for the rth test, and Σ denotes summation over the different tests.

Remembering that y takes one of the five undetermined values A, . . . E, we see that in terms of the matrix of coefficients

$$Sy^2 = \left\{\begin{matrix} 18 & & & & \\ & 23 & & & \\ & & 22 & & \\ & & & 22 & \\ & & & & 19 \end{matrix}\right\}$$

The terms in the $\Sigma(Y_r\overline{y}_r)$ are found from the bottom marginal subtotals in Table 2. For example, the coefficient of 2 BC is

$$\frac{1\times4}{11} + \frac{2\times1}{8} + \frac{0}{8} + \ldots + \frac{1\times1}{7} = 3.330$$

Hence

$$\Sigma(Y_r\overline{y}_r) = \left\{\begin{matrix} 5.345 & 2.328 & 3.570 & 3.647 & 3.110 \\ & 10.637 & 3{,}330 & 3.637 & 3.069 \\ & & 6.686 & 4.181 & 4.232 \\ & & & 6.566 & 3.970 \\ & & & & 4.620 \end{matrix}\right\}$$

The sum of squares within tests which we denote by W_{yy} is, therefore

$$W_{yy} = \left\{\begin{matrix} 12.655 & -2.328 & -3.570 & -3.647 & -3.110 \\ & 12.363 & -3.330 & -3.637 & -3.069 \\ & & 15.314 & -4.181 & -4.232 \\ & & & 15.434 & -3.970 \\ & & & & 14.380 \end{matrix}\right\} \quad \ldots (3.21)$$

We may note, as a check, that all rows of this matrix (completed symmetrically across the diagonal) add to zero.

We now find the sum of products of y and x within tests

$$= S(yx) - \Sigma(Y_r\overline{x}_r)$$

where S and Σ have the same meanings as before.

$S(yx)$ is a linear function in A, . . . E, the coefficients being found by summing the products of x and the right hand marginal subtotals in Table 2. The coefficient of A, for example, is

$$2\times0.954 + 4\times1.130 + \ldots + 1\times1.932 = 25.477$$

The total sum of products is, therefore,

$$S(yx) = 25.477 \quad 40.930 \quad 39.590 \quad 41.732 \quad 37.867$$

The subtotals and means of x for the different tests are given in Table 3, so that we sum the products of entries in a bottom margin of Table 2, and the corresponding $\overline{x}$ from Table 3, to give $\Sigma(Y_r\overline{x}_r)$

For example, the coefficient of A is

$$1\times2.1648 + 2\times1.6013 + \ldots + 1\times1.6686 = 29.717$$

Hence

$$\Sigma(Y_r\overline{x}_r) = 29.717 \quad 42.934 \quad 39.740 \quad 39.307 \quad 33.899$$

By subtraction we find the within sum of products

$$W_{xy} = -4.240 \quad -2.004 \quad -0.150 \quad 2.425 \quad 3.968 \ldots (3.22)$$

As a check we notice that the sum of the coefficients is zero.

Finally we evaluate the within sum of squares for x.

$S(x^2)$ is given by the sum of products of the numbers in the extreme right-hand margin of Table 2 and the squares of the corresponding x.

$$S(x^2) = 342.428$$

$\Sigma(X_r\overline{x}_r)$ is the sum of products of subtotals and means in Table 3.

$$\Sigma(X_r\overline{x}_r) = 23.813\times2.1648 + \ldots + 11.680\times1.6686 = 339.254$$

Hence the within tests sum of squares is

$$W_{xx} = 3.174 \qquad \ldots (3.23)$$

3.3. Minimizing the Error

Following a procedure known as the Analysis of Covariance explained in "Statistical Methods for Research Workers," and forgetting for the moment that W_{yy} and W_{xy} are functions of A, . . . E, we find the common coefficient of regression b, of y on x for all tests

$$b = W_{xy}/W_{xx}$$

The portion of the within sum of squares of y accounted for by regression is

$$(W_{xy})^2/W_{xx}$$

We may in fact analyze the within variance in the conventional way:

	Degrees of Freedom	Sum of Squares
Regression of y on x . .	1	$(W_{xy})^2/(W_{xx})$
Deviations from the regression lines	85	$W_{yy} - (W_{xy})^2/(W_{xx})$
Within tests	86	W_{yy}

The metrical values for A, . . . E have, however, yet to be assigned, and it is clear that the proper values are those which minimize error, i.e., sum of squares of deviations from the regression lines, and maximize the portion accounted for by regression. This is achieved by maximizing the ratio of regression square to total sum of squares, i.e.,

$$(W_{xy})^2/W_{xx}W_{yy}$$

for variations in A, . . . E.

Differentiating in turn with respect to A, . . . E, we find a set of five linear simultaneous equations in A, . . . E, of which the coefficients and right-hand sides may be written as

$$W_{yy} = kW_{xy}$$

where $k = W_{yy}/W_{xy}$ when the solution values for A, . . . E are inserted. Since k is the same as all equations, and since the scores are in any case multiplicable by any constant, we may drop the k and solve the equations.

$$W_{yy} = W_{xy}$$

TABLE 3. SUMS AND MEANS OF x = LOG FLEXINGS

Rubber Number		1	2	3	4	5	6	7	9	10	Grand Totals and General Mean
First Test	n	11	8	8	3	4	4	4	6	7	
	$X = \Sigma x$	23.813	16.733	12.810	3.436	4.934	7.860	6.152	12.617	13.969	
	$\overline{x}$	2.1648	2.0916	1.6013	1.1453	1.2335	1.9650	1.5380	2.1028	1.9956	
Second Test	n	11	7	7	4	1	5	4	3	7	104
	$X = \Sigma x$	21.013	12.343	11.680	6.152	1.130	8.396	5.587	5.291	11.680	185.596
	$\overline{x}$	1.9103	1.7633	1.6686	1.5380	1.1300	1.6792	1.3968	1.7637	1.6686	1.78458

Moreover, since any constant may be added to all the scores, we may set, e.g., E = 0, and solve the four equations formed from the above by dropping the last equation and the last term of each of the remaining four.

3.4. Arithmetical Procedure

As before, the actual arithmetic calculations will make the method clear. The four equations in A,B,C,D are

A	B	C	D		
12.655	–2.328	–3.570	–3.647	=	4.240
–2.328	12.363	–3.330	–3.367	=	2.004
–3.570	–3.330	15.314	–4.181	=	0.150
–3.647	–3.637	–4.181	15.434	=	-2.425

Solution proceeds in the usual way by reducing the number of equations by one at each stage, and we finally find

$$\begin{aligned} A &= 0.4927 \\ B &= 0.3465 \\ C &= 0.2280 \\ D &= 0.1027 \\ E &= 0 \end{aligned} \qquad \ldots (3.41)$$

The regression coefficient is found from W_{xy}/W_{xx} where now, of course, we may substitute the above scores in the expression for W_{xy}.

$$b = -0.8093 \qquad \ldots (3.42)$$

For reasons which will appear in a minute, we choose to scale the scores so that the regression coefficient is –1. We therefore divide the above scores by 0.8093. Further, we will subtract the value for C from all scores so as to make C zero, thus arriving at the scores in the second column.

		Final Scores
A	0.6088	0.327
B	0.4282	0.146
C	0.2818	0
D	0.1269	–0.155
E	0	–0.282 ...(3.43)

4. Determination of Mean Strengths

We are now able to calculate a mean for each test which fairly represents the strength of the rubber under test. Since we have arranged the regression coefficient to be –1, the regression line which best fits the data for one test is

$$y = \bar{y} - (x - \bar{x})$$

This line intersects the axis $y = 0$ at

$$x_0 = \bar{x} + \bar{y} = \overline{x + y} = \bar{w}$$

Hence we may find x_0 by writing down for each observation from the first A to the last E the sum w of the x and the score y, and averaging. Thus for No. 2 in the first test we have:

	x	y	$W=x+y$
A	1.829	.146	1.975
B	1.932	.146	2.078
C	2.015	.000	2.015
D	2.084	– .155	1.929
D	2.145	– .155	1.990
D	2.197	– .155	2.042
D	2.244	– .155	2.089
E	2.287	– .282	2.005
8		$\Sigma w =$	16.123
		$\bar{w} =$	2.0154

Alternatively, since Σx is already known from Table 3 we may find thus

$$\begin{aligned} \Sigma w &= \Sigma x + \Sigma y \\ &= 16.733 + 2\,(0.146) - 4(0.155) - (0.282) \\ &= 16.123 \\ \therefore\ \bar{w} &= 2.0154 \end{aligned}$$

The mean strength of the 18 pieces are listed in Table 4.

We may interpret $\bar{w}$ as the estimate of the log of the number of flexings required to reduce the sample to condition C, i.e.,

$$\text{antilog } 2.0154 = 103.6$$

Hence 103,600 flexings reduce the sample to condition C. However, we wish to emphasize that nothing is gained by converting back to actual flexings, since standard errors will be found for and comparisons will always be made between the $\bar{w}$ for different rubbers. Hence it is more convenient to regard $\bar{w}$ as the real measure of rubber flexing resistance.

We may notice also that there is no particular reason for having made C = 0. If all the scores are increased by a constant, the values of $\bar{w}$ are all increased by the same constant, and consequently comparisons will be unaltered.

5. The Analysis of Variance

We may now proceed to make an Analysis of Variance on the quantities $w = x + y$. In the normal way the various items in the analysis would be obtained from the corresponding entries in the Analysis of Variance and Covariance of x and y. In the present case, however, we find it more convenient to proceed from Table 4, showing the subtotals and means for the 18 tests, for the nine types of rubber, and for the first and second replication. From this table we calculate the sums of squares for the 17 degrees of freedom between tests, analyzed into:

	Degrees of Freedom
Between rubbers	8
Between replications..................	1
Interaction	8
Between tests	17

Table 4. Subtotals and Means of $w = x + y$

Rubber Number		1	2	3	4	5	6	7	9	10	Totals
First Test	n	11	8	8	3	4	4	4	6	7	55
	Σw	23.130	16.123	12.717	3.935	5.306	7.896	5.861	12.945	14.845	102.758
	$\bar{w}$	2.1027	2.0154	1.5896	1.3117	1.3265	1.9740	1.4652	2.1575	2.1207	1.86833
Second Test	n	11	7	7	4	1	5	4	3	7	49
	Σw	21.094	12.551	11.561	5.861	1.276	8.578	5.477	5.764	11.152	83.314
	$\bar{w}$	1.9176	1.7930	1.6516	1.4653	1.276	1.7156	1.3692	1.9213	1.5931	1.70029
Both Tests	n	22	15	15	7	5	9	8	9	14	104
	Σw	44.224	28.674	24.278	9.796	6.582	16.474	11.338	18.709	25.997	186.072
	$\bar{w}$	2.0102	1.9116	1.6185	1.3994	1.3164	1.8304	1.4172	2.0788	1.8659	1.78915

Thus, for example, the sum of squares between tests is found by summing for all tests the product of the subtotal and mean and subtracting the product of grand total and general mean:

$$= 23.130 \times 2.1027 + \ldots + 11.152 \times 1.5931 - 186{,}072 \times 1.78915$$

Similarly the sum of squares for differences between rubbers is found from the subtotals and means for the two replications combined

$$= 44.224 \times 2.0102 + \ldots + 25.997 \times 1.8659 - 186.072 \times 1.78915$$

The within sum of squares for y is found from the within matrix (3.21) by multiplying the entries of each row by the scores (3.43) giving the subtotals in the right-hand margin; and then again multiplying these subtotals by the scores and summing. Omitting the middle row column (since $C = 0$) we find

$$\begin{Bmatrix} 12.655 & -2.328 & -3.647 & -3.110 \\ & 12.363 & -3.637 & -3.069 \\ & & 15.434 & -3.970 \\ & & & 14.380 \end{Bmatrix} \begin{array}{r} 5.2406 \\ 2.4729 \\ -2.9963 \\ -4.9048 \\ \hline 3.9223 \end{array}$$

The portion of this within sum of squares which is accounted for by regression is

$$b^2 W_{xx} = W_{xx}$$

since b has been made $= -1$

From (3.23) we have

$$W_{xx} = 3.174$$

Hence the sum of squares for deviations from the regression line, i.e., the within sum of squares for w is

$$3.922 - 3.174 = 0.748$$

The only question which remains before assembling the various items of the Analysis of Variance is the allocation of degrees of freedom. There are in all $103 - 17 = 86$ degrees of freedom for within sum of squares of w. Of these the fitting of the regression would normally remove one degree of freedom. Since, however, the five values for A, . . . E have also been ascertained (representing three independent parameters), we have the following partition of degrees of freedom.

Regression and allocation of scores........	4
Error = deviations from regression lines..	82
Within tests..........................	86

We may therefore assemble the Analysis of Variance in Table 5.

TABLE 5. ANALYSIS OF VARIANCE OF w

	Degrees of Freedom	Sum of Squares		Mean Square
Between kinds of rubber	8	5.857		0.732
Within kinds of rubber				
Between replications	1	0.733		0.733
Interaction	8	0.949		0.118
Between tests......	17		7.539	
Error = within tests....	82		0.748	0.00912
Total	99		8.287	

6. Discussion of the Analysis of Variance

The first thing which may be noted about Table 5 is how surprisingly successful the fitting of a set of regressions of common slope has been in absorbing the variance. Out of 99 degrees of freedom, the 82 degrees of freedom for error account for only about 11% of the total variance.

If we assume that the only source of error were that due to the discontinuity of the qualitative scale, then the mean square for error should be of the order of $h^2/3$, where $2h$ is the distance between successive points on the scale. Putting approximately

$$\begin{aligned} 8h &= 0.327 - (-0.282) \\ &= 0.609 \\ h &= 0.076 \\ h^2/3 &= 0.0019 \end{aligned}$$

Thus the calculated standard error is a little over twice the absolute theoretical minimum.

Some improvement may still be possible in the accuracy of qualitative scoring, but this source of error is negligible compared with a very grave source of error which will appear immediately.

The numbers $\bar{w}$ in Table 4 can be regarded as true measures of the flexing resistances of the piece of rubber in each of the 18 particular tests. They are, however, in no sense measures of the flexing resistance of that kind of rubber, unless the same rubber will give consistent results in a repeated test. If the only source of error were errors of observation, then the mean square for replication and for interaction between rubbers and replication would both be comparable with the mean square for error. Actually both are so very much greater that there is no shadow of doubt about their significance.

Of course it may be that the additional variability is due to the inherent non-uniformity of each kind of rubber, and as such is unavoidable. There is, however, further evidence that this is not the complete explanation, for we may compare the mean square for replication against the mean square for interaction, giving a variance ratio of 6:2, which is above the 5% level of significance. Thus it appears that even granting non-uniformity of the material, the average strength was significantly lower on the second series of tests than on the first.

We therefore suggest that the testing cannot be said, in the present case, to be proceeding satisfactorily. It should be possible to bring the mean square within rubbers (i.e., nine degrees of freedom, replication + interaction), down to a figure comparable with error.

If, however, this proves to be impossible, then the observed variance for within rubbers is the appropriate one to use for testing the significance of comparisons between rubbers.

7. Comparison of Test Means

If we denote the error or mean square by $\sigma^2 = 0.00912$, then the variance of any $\bar{w}$ based on n observations is σ^2/n. For example, for rubber No. 1 in test 1 we have

$$\begin{aligned} \bar{w} &= 2.1027 \\ n &= 11 \\ \text{variance} &= 0.00083 \\ \text{standard error} &= 0.0288 \end{aligned}$$

whereas for the second test on the same rubber

$$\begin{aligned} \bar{w} &= 1.9176 \\ n &= 11 \\ \text{variance} &= 0.00083 \end{aligned}$$

The standard error of the difference is therefore

$$\sqrt{2 \times 0.00083} = 0.0407$$

the difference of the means is

$$2.1027 - 1.9176 = 0.0851$$

and is therefore just significant (5%).

It should be remarked however that these tests of significance and those made in the Analysis of Variance are slightly vitiated by the errors of the determination of the quantitative scores A, . . . E. Since, however, the exact tests are elaborate, and since, moreover, the scores will have to be redetermined on more extensive data, we may content ourselves at this stage with approximate tests.

8. The Adequacy of the Logarithmic Scale

It remains to be considered whether there are still differences between the rubbers, other than those expressed by the mean $\overline{w}$. In other words, has the logarithmic scaling of the number of flexings been successful? The smallness of the residual variance, already pointed out, shows that if there are any other differences between tests, they must be very slight.

Owing to scantiness of the data, particularly at the lower end of the log scale, and the failure to obtain true replication, it is hardly worth while to make a thorough test of the adequacy of the log scale, but we may at least indicate how this should be done and leave the more thorough examination to a later date.

Differences between tests, if they exist, will be revealed mainly in heterogeneity of the regressions of the quantitative scores y on x. We have arranged for the common regression to be –1, but we may calculate the individual regressions of y on x in each test. For example, in rubber No. 2 first test we find

$$\begin{aligned} S(y-\overline{y})\,(x-\overline{x}) &= -0.1638 \\ - \quad S(x-\overline{x})^2 &= 0.1757 \\ b &= -0.9323 \end{aligned}$$

This individual regression differs from the general regression, which was made equal to –1, by an amount

$$\delta b = +0.0677$$

The difference is, however, not significant, for if we take

$$(\delta b)^2 \times S\,(x - \overline{x})^2 = 0.00081$$

we find a mean square less than the mean square for error. The differences of individual regressions from the general regression for four typical tests are listed in Table 6, which suggests that there are no differences in the rates of breakdown when expressed on a logarithmic scale.

TABLE 6. RESIDUAL REGRESSIONS OF SCORES ON LOG FLEXINGS

First Test Rubber Number	$\overline{w}$	δb	$S(x-\overline{x})^2$	$(\delta b)^2 S(x-\overline{x})^2$
1	2.1027	−0.003	0.339	0.0000
2	2.0154	+0.086	0.179	0.0013
3	1.5896	+0.091	0.494	0.0041
5	1.3260	−0.156	0.173	0.0042

If it appeared that the residual regressions were heterogeneous, there would be still the question of whether the heterogeneity could be removd by a slight alteration in scaling. Such a complication would be very unwelcome, but a glance at the four tests in Table 6 shows that it is unlikely that this would be necessary. The need of a different scaling would be indicated by a tendency for test pieces with a high mean to break down too slowly, and those with a low mean to break down too quickly, or *vice versa*. But it appears that of the four listed the test with the highest mean has a very slight negative regression; the next highest, positive; the second lowest, positive; and the lowest, again negative.

The success of the log scale is again brought out in Figure 1, which shows y plotted against x for five of the tests, together with the five regression lines of slope –1, which best fit the five sets of data.

Finally, although it is very probable that more extensive data would show no differences whatever between rubbers, other than those indicated by their mean $\overline{w}$, we must point out that even if slight residual differences remain, these will be of no practical consequence, and the methods of the above analysis will be quite adequate for all practical purposes.

9. Non-Mathematical Summary

Various kinds of rubber are subjected to flexing by a machine. At intervals the machine is stopped, and numbers of flexings are noted, and the qualitative state of breakdown of the rubber by comparison with a scale of samples, lettered A, B, . . . E.

The analysis of the present paper shows that the intensity of treatment to which a test piece has been subjected should be measured by x, the logarithm of the number of flexings. It is then a straightforward matter to calculate the quantitative scores y, which should be assigned to the qualitative scale.

When this has been done, it is shown that the rates of breakdown measured against a log scale are the same for all test pieces, and the behavior of a test piece may therefore be completely summarized in a single number

$$\overline{w} = \overline{x} + \overline{y}$$

i.e., the mean of the x's plus the mean of the scores from the first A to the last E.

The mean $\overline{w}$ is, therefore, the true measure of the flexing resistance of the rubber. A high precision will be obtainable by this method though it appears in the present data that there are big differences in repeated tests on the same kind of rubber.

It is hoped that a more extensive body of data will soon be available for a more thorough investigation on the same lines. In the experiment on which it is based it would be desirable to use a rather more finely graduated qualitative scale and to take observations at intervals which are equally (or approximately equally) spaced on a logarithmic scale.

Acknowledgments

I am indebted to the Research Association of British Rubber Manufacturers, who suggested the problem and supplied the data, and to Dr. R. G. Newton for criticism of the typescript.

References

The subject of discriminant function analysis and qualitative scoring is very recent and incomplete. An example resembling the method of the present paper will however be found in Ex.46.2, Chapter VIII, of the seventh edition of: R. A. Fisher, "Statistical Methods for Research Workers." Oliver & Boyd. Edinburgh.

The theory of the Test of Significance is given in: R. A. Fisher, "The Sampling Distribution of Some Statistics Obtained from Non-Linear Equations," *Annals of Eugenics*, IX, pp. 238-249.

Further information on the testing technique and references to other work will be found in: R. G. Newton, "A Quantitative Method of Expressing Flex-Cracking Results," *Trans. Inst. Rubber Ind.*, XV, pp. 172-184.

Agreement to Permit United States Reserve of Rubber

CREATED under the authority of an amendment, approved June 25, 1940, to the Reconstruction Finance Corp. Act and according to the announcement on July 1 by Federal Loan Administrator Jesse H. Jones, the Rubber Reserve Co. has been established by the R. F. C. to purchase on the open market and hold for emergency use a supply of crude rubber ranging between 100,000 and 150,000 tons.

The Rubber Reserve Co. is capitalized at $5,000,000, which amount will be paid in by the Reconstruction Finance Corp. It is understood that arrangements are contemplated whereby members of the rubber industry will participate in this capitalization of the Rubber Reserve Co. Plans are currently being formulated in this direction. The Reconstruction Finance Corp. has authorized loans of $65,000,000 to the Rubber Reserve Co. for the purchase of the rubber. It will be the policy of the Rubber Reserve Co. to limit its purchases to excess production, and domestic consumers will be expected to cover their current requirements of rubber in cooperation with the government agencies.

After a conference between representatives of the R. F. C., the rubber industry in the United States, and Sir John Hay representing the International Rubber Regulation Committee, the I. R. R. C. announced on July 5, 1940, that the rate of release of rubber for the last half of 1940 had been revised upward from 80% to 85% of the basic quotas. On July 20, 1940, Mr. Jones released for publication on July 21 an agreement entered into on June 28 and 29 between the Reconstruction Finance Corp., the Rubber Reserve Co., and the International Rubber Regulation Committee. Because of its far-reaching influence and wide interest to the American rubber industry this agreement is published herewith in verbatim form.

Memorandum of Agreement

Memorandum of Agreement dated as of June 29, 1940, between Reconstruction Finance Corp. (herein called the "Corporation"), RUBBER RESERVE CO., a corporation created by the Reconstruction Finance Corp. (herein called the "Company"), and THE INTERNATIONAL RUBBER REGULATION COMMITTEE (herein called the "Committee").

One

(a) In order to aid in the National Defense Program, the Corporation agrees that it will make a loan or loans to the Company upon satisfactory terms and conditions, in such amount as may be necessary, and the Company undertakes, with the proceeds thereof, to acquire by purchase a reserve stock of crude plantation rubber (*Hevea Brasiliensis*) of a minimum quantity of 100,000 tons and a maximum quantity of 150,000 tons for shipment prior to December 31, 1940, such rubber to be designated a reserve stock.

(b) In addition, the rubber manufacturers as represented by the Rubber Reserve Co., will endeavor to continue their current purchases of crude rubber within the range price hereinafter mentioned in such volume as will be necessary to meet current requirements and to maintain within the United States during the period that the reserve stock is being accumulated a normal stock for current requirements and purposes. Such a stock shall be interpreted as a quantity of plantation rubber of 150,000 tons [for the entire industry in the United States] and shall be in addition to the reserve stock above referred to.

(c) To the extent that the manufacturing rubber industry fails to maintain its stock at the figure aforementioned, the Rubber Reserve Co. to that extent undertakes to increase its purchases above the maximum of 150,000 tons, provided that any rubber so purchased above said maximum may be released to manufacturers within the United States and shall not be subject to the provisions of Paragraphs Six and Seven hereof.

Two

In consideration of the undertakings above described, John George Hay, Kt., agrees, on behalf of the Committee that the Committee in exercise of the powers conferred upon it by Article IV, Treaty Series No. 74, 1938, will permit the release of the quantity of rubber which may be necessary for the accomplishment of the purposes herein described as well as for all other known demands.

Three

If, notwithstanding the action of the Committee, acting in full accord with the provisions of this agreement, the supply of rubber or the facilities for the transportation thereof should be inadequate for the accomplishment of the purposes herein set out within the period named, purchases shall continue nevertheless for shipment subsequent to December 31, 1940, as may be necessary for the accumulation of the reserve stock of crude plantation rubber of 150,000 tons.

Four

(a) It is understood that during the period necessary for the purchase and accumulation of the reserve stock of rubber hereinabove mentioned, such rubber shall be purchased at not less than 18 or more than 20¢ (United States Dollars) a pound c.i.f. New York for standard smoked sheet, packed in cases or in bales at seller's option, with the usual differential for other qualities and other forms of purchases, exempli gratia Ex. Godown, f.o.b., landed.

(b) Purchases, sales, and deliveries shall be made under contracts adopted and now in use by recognized Rubber Trade Associations, and any claims or disputes arising regarding insurance, shipment, packing, quality, payment, freight, and cognate matters shall be settled in accordance with the recognized customs of the rubber trade.

Five

The Committee, represented by John George Hay, Kt., undertakes to encourage producers of rubber to be ready sellers at the range between the two prices mentioned in Paragraph Four hereof, 18 to 20¢ per pound c.i.f. New York, payable in dollars, New York Exchange. The Company undertakes to use its best endeavors so to arrange its purchases that the market price will be maintained within the range specified.

Six

The Company agrees that as the reserve stock is acquired, it will be held separate from the normal trade stocks and will not be disposed of (otherwise than for the purpose of replacement through equivalent quantities as may be expedient for the prevention of deterioration and in such manner that the quantity thereof will at all times be maintained intact) except as required by the Government of the United

(*Continued on page* 44)

German Patents Relating to Synthetic Rubber-like Materials—IV

Law Voge[1]

THEN on November 13, 1925, Dr. K. Meisenburg assigned to I. G. Farbenindustrie, A.G., Frankfurt, a patent application[2] covering a "Process for the Removal of Liquid Polymerizates from Rubber-like Synthetic Masses." These liquid polymerizates are impurities; consequently the purpose of this invention is the purification of the synthetic rubber product. Its claim reads: "Treating the rubber-like product with pulverous, absorbing material such as activated carbon, etc." In the example given, a polymerization product from heating isoprene is rolled to sheets and then heated to 40° C. with the same weight of activated carbon for nine hours. This polymerization product is entirely odorless and free from liquid polymerizate. The latter readily can be recovered from the carbon by steam treatment. "Activated silicic acid" (that is, "activated" silica gel) can replace the activated carbon.

A patent[3] was applied for on January 9, 1927, by Drs. Martin Luther and Claus Heuck, and assigned to the I. G. Farbenindustrie, on a "Process for Polymerization of Butadiene Hydrocarbons." The claim of this invention reads: "Use of soapy emulsifiers to form aqueous emulsions of the butadiene hydrocarbons, preferably with the addition of buffer mixtures at a hydrogen ion concentration of 4 - 8.5."

Six examples are given. Example 1 employs: isoprene, 100 parts, water, 400 parts, ammonium oleate, 10 parts, sodium phosphate (tertiary), three parts, sodium phosphate (secondary), two parts. The mixture is emulsified, for instance in a turbomixer, and is then heated in a pressure container at 60 to 80° C. for three weeks. The isoprene has largely polymerized to a latex. From this the polymerization product can be precipitated by the addition of acids such as acetic, hydrochloric, etc., or by the addition of acidic buffer mixtures having a hydrogen ion concentration of 3 - 4. The product is rubber-like and can be rolled and vulcanized. Other compounds proposed for use in the other examples of this patent are: sodium oleate, turkey-red oil, ammonia, paraffine oil, saponin, and Marseilles soap.

On January 15, 1927, application was made for patent[4] by Drs. W. Bock and E. Tschunkur, and assigned to the I.G., on a "Process for the Preparation of Synthetic Rubber," the claim of which states: "Hydrocarbons appropriate for the preparation of rubber such as butadiene, isoprene, dimethylbutadiene, etc., or their analogs, alone or in mixtures with each other, are emulsified with aqueous viscous liquids and/or emulsion-forming materials, and polymerization between these is caused to occur in the presence of oxygen or of oxygen-producing reagents." *Example:* A mixture of isoprene, 50 kilograms, dimethylbutadiene, 50 kilograms, egg albumin, one kilogram, Marseilles soap, one kilogram, water, 20 kilograms, is polymerized while heated in the presence of twice or thrice the volume of oxygen gas. Other similar examples are presented. The purpose of the invention is to shorten the time of polymerization.

Bock and Tschunkur assigned to the I.G. another application for patent[5] on June 11, 1927, covering a "Process for Improving the Quality of Synthetic Rubber or of Rubbery Substances." This invention chiefly concerns the improved use of fillers. The claim reads: "The diolefine hydrocarbon polymerization products, single or combined, are mixed with finely subdivided carbon, for instance carbon black, with or without other fillers, vulcanization accelerators, etc., and vulcanized by known methods." Eight examples are presented, the first of which follows: A mixture of dimethylbutadiene rubber, 78 parts by weight, gas carbon, 20 parts by weight, sulphur, 3.15 parts by weight, zinc oxide, 9.4 parts by weight, diphenylguanidine, one part by weight, is worked up in the mixing rolls and vulcanized at 140° C. for 50 minutes. The physical properties of the product are 100% higher than for such products without the incorporation of the gas carbon.

"Process for the Preparation of Synthetic Rubber and Rubber-like Substances" forms the basis of patent application[6] on July 21, 1927, by Drs. Meis, Klein, and Tschunkur, and assigned to the I.G. Here the claim specifies: "Process for the preparation of rubber-like polymerization products from butadiene hydrocarbons, alone or in mixture with each other, in aqueous emulsions with or without the addition of emulsoids, optionally with heating, characterized in that the polymerization is accomplished after the addition of small amounts of finely divided or colloidal heavy metal oxides such as do not evolve hydrogen peroxide through reaction with acids."

Example: Butadiene, 100 kilograms, 10% solution of colloidal manganese dioxide, 100 liters, are mixed in a sealed apparatus with stirring facilities and heated to 60° C. for about one week when polymerization is ended. The yield in rubber-like material is about 60 kilograms. Omitting the use of manganese dioxide, only traces of rubber are formed under these conditions. Isoprene can replace butadiene as initial material.

On October 18, 1927, Drs. Beck and Luther assigned to the I.G. an application for patent[7] on a process for the "Preparation of Rubber-like Polymerization Products from Butadiene Hydrocarbons by the Emulsion Process." The main claim specifies: "The butadiene hydrocarbons are so treated with aqueous solutions containing polymerization accelerating substances that a cream- or jelly-like mass results containing at least 75% of butadiene hydrocarbons and this, with or without the aqueous layer, and preferably without stirring, is subjected to polymerization." This is a very general claim, but the example presented elucidates it. An emulsion is prepared by actively stirring seven parts by weight of isoprene into 15 parts by weight of skim milk (pH=6.0-6.9); and two parts by weight of hydrogen peroxide (3% solution). This mixture is left in a sealed tube "for some time" to form two strata. The upper, cream-like stratum is about 90% isoprene with a little water and small amounts of other substances. The lower stratum is not described. The tube is kept horizontal for three days at 90 to 100° C. A light, very elastic rubber of excellent properties results

[1] Research chemist and engineer, Washington, D. C.
[2] No. 511,540, granted Oct. 31, 1930.
[3] No. 558,890, Sept. 19, 1932.
[4] No. 511,145, Oct. 27, 1930.
[5] No. 578,965, June 19, 1933.
[6] No. 515,143, Dec. 24, 1930.
[7] No. 533,885, Sept. 19, 1931.

and is readily separated from the adhering casein layer. Glue can replace the milk, and butadiene can be substituted for the isoprene.

A patent[8] was applied for by Boris Bysow, of Leningrad, on December 20, 1927, entitled, "A Process for the Preparation of Rubber-like Polymerization Products of Butadiene Hydrocarbons." The claim is characterized by the presence of two or more tautomeric substances in the polymerization process. As an example, 500 grams of butadiene, 2.5 grams of benzoyl acetate, and 2.5 grams of diazoamidobenzene were mixed and polymerized in a closed container at 60 to 100° C. The container need not be shaken. After 14 days 170 grams of polymerizate were obtained. This patent introduces an interesting comparison of reaction times which employs one and two catalysts:

	Catalyst	100 Grams Butadiene	Time (Days)	Yield of Polymer %
1.	Diazoamidobenzene	1.0	60	18.7
2.	Acetyl acetone	1.0	30	6.2
3.	Benzoylacetate	1.0	120	11.6
4.	Phenyl-mustard oil	1.5	17	12.5
	WITH TWO CATALYSTS (MIXED)			
1.	Diazoamidobenzene Benzoylacetate	1.0 1.0	43	32.6
2.	Benzoylacetate Acetylacetone	1.0 1.0	17	32.9
3.	Phenyl-mustard oil Acetylacetone	1.0 1.0	18	46.8
4.	Diazoamidobenzene Acetylacetone	1.0 1.0	34	36.8
5.	Diazoamidobenzene Phenyl-mustard oil	1.0 1.0	26	32.2

Drs. Konrad and Siefken assigned to the I.G. a patent application[9] of January 17, 1928, on a "Process for the Coagulation of Milky Emulsions of Rubbery Polymers of Butadiene Hydrocarbons." The claim covers the cooling of the emulsions to temperatures below 0° C. The purpose of this patent is the coagulation of the polymerizate.

Example: 100 parts by weight of isoprene are emulsified by intense shaking or stirring with 50 parts by weight of a 10% solution of sodium oleate. This emulsion, then, under gentle movement is heated to 60° C. for four days. The stiff cream resulting is made to a latex with 300 parts of water, and the whole then maintained cold at 15° C. for 1½ hours. After remelting, the aqueous oleate phase can be mechanically separated from the coagulum.

A "Process for the Preparation of Linoleum or Lincrusta from Synthetic Rubber" forms the subject of a patent application[10] of January 21, 1928, assigned to the I.G. by Dr. E. Tschunkur. This is one of the first patents devoted to an application of synthetic rubber and the claim reads: "Combining the customary filling materials such as cork, peat meal, clay, magnesia, chalk, etc., instead of with the customary binders, such as linoxyn, etc., wholly or partly with synthetic rubbers and optionally vulcanizing the product." The following example is presented: dimethylerythrene rubber, eight parts, resin, five parts, oil, five parts, cork, sawdust, etc., 50 parts, heavy spar or lithopone, 10 parts, magnesia, 12 parts, ochre, 10 parts. These are intimately mixed on the rolls until a coherent solid linoleum plate is obtained.

Under the title, "Process for the Improvement of the Quality of Rubber-like Polymerization Products of Butadiene Hydrocarbons," patent[11] was applied for on January 29, 1928, by Drs. W. Bock and E. Tschunkur and assigned to the I.G. This is a supplement to Patent 578,965.[5] It claims: "Improving the quality of the vulcanizate in that, in place of finely divided carbon, other fillers are used having a degree of fineness of under 0.3 [micron]." *Example:* An emulsion of albumin emulsion of erythrene- or isoprene-rubber, 100 parts by weight, silicic acid, colloidal, (i.e. silica gel), 20 parts by weight, is mixed with the ordinary sulphur vulcanization mixture and rolled and vulcanized as usual. Finely subdivided magnesium carbonate and Dixie clay are also proposed for use in this patent.

On March 17, 1928, Drs. Lecher and Koch assigned to the I.G. a patent[12] on the "Process for the Preparation of Rubber-like Products." The purpose of this patent is to increase the yield of the product. The claim covers the homogenizing of the emulsions before the polymerization.

Example: 75 parts by volume of isoprene are emulsified with 100 parts by volume of 10% sodium oleate solution by shaking or stirring. The emulsion is forced through a glass sinter and the emulsified hydrocarbon particles are thereby made smaller. This homogenized emulsion under slight movement is polymerized at 60° C. The time required is two days. The yield is 90 to 95%. A similar reaction and quantitative yield can be obtained with butadiene. The patent cites a homogenizing machine covered by German Patent 163,372.

(To be continued)

[8] No. 521,903, Apr. 2, 1931.
[9] No. 537,032, Oct. 29, 1931.
[10] No. 575,286, Apr. 26, 1933.
[11] No. 580,540, July 12, 1933.
[12] No. 526,304, Mar. 13, 1931.

Agreement

(Continued from page 42)

States of America for its defense program or in the event of normal supplies being interrupted through hostilities, or any similar emergency. In such latter event, releases from the reserve stock will be permitted only to the extent necessary to maintain trade stocks at their normal level.

Seven

Subject to the provisions of Paragraph Six, the Company agrees that the reserve stock shall be held intact until December 31, 1943, thereafter to be liquidated at not more than 100,000 tons per annum and in such manner as least to disturb the world price of crude rubber. The Company undertakes to inform the Committee of its intention to liquidate the reserve rubber supply in accordance with this provision and to keep the Committee informed as to the progress of such liquidation.

Eight

In the event of circumstances under which the decisions of the Committee, through causes beyond its control, cease to be operative in the territories of the Netherlands' East Indies or in the territories commonly known as British Malaya, then the Committee agrees to consult immediately with the Corporation and the Company for the purpose of determining what action shall be taken with respect to the provisions of this memorandum.

RECONSTRUCTION FINANCE CORPORATION
By (s) Emil Schram
Chairman

RUBBER RESERVE COMPANY
By (s) H. J. Klossner
President

INTERNATIONAL RUBBER REGULATION COMMITTEE
By (s) J. Geo. Hay

APPROVED:
(s) Jesse H. Jones
Federal Loan Administrator

Composite Elasticity of Rubber—II

H. Mark[1]

IN PART I[2] it was pointed out that the high elasticity of rubber and related substances is a complicated phenomenon during which at least three different elementary processes take place and overlap each other. At low elongations the kinetic energy of the long chain molecules is mainly responsible for the elasticity; at higher extensions the potential energy plays the predominant role. In Part I emphasis was placed on the first elementary process of elasticity in which kinetic energy is the important factor. Part II will deal chiefly with the other two processes, involving potential energy chiefly, and an attempt will be made to correlate the total behavior of rubber elasticity with the fundamental concepts presented.

Equilibrium between Amorphous and Crystallized Phase

An attempt has been made to describe how an isolated long chain molecule, exhibiting a certain degree of internal flexibility, would behave if stressed, and the result in the case of a macroscopic piece of rubber has been evaluated simply by multiplying the quantitative behavior of a single chain by the number of long chain molecules in the sample.

Thus we have entirely neglected the intermolecular forces which act not only between different chains in the same sample, but also between different parts of the same chain. The characteristics of these forces can be illustrated by a potential energy curve, which shows the mutual energy of the two interacting groups as a function of their distance. Extensive studies of intermolecular action carried out during the last ten or fifteen years[3] have made possible the drawing of such an energy curve as is shown in Figure 1 with rather fair accuracy.

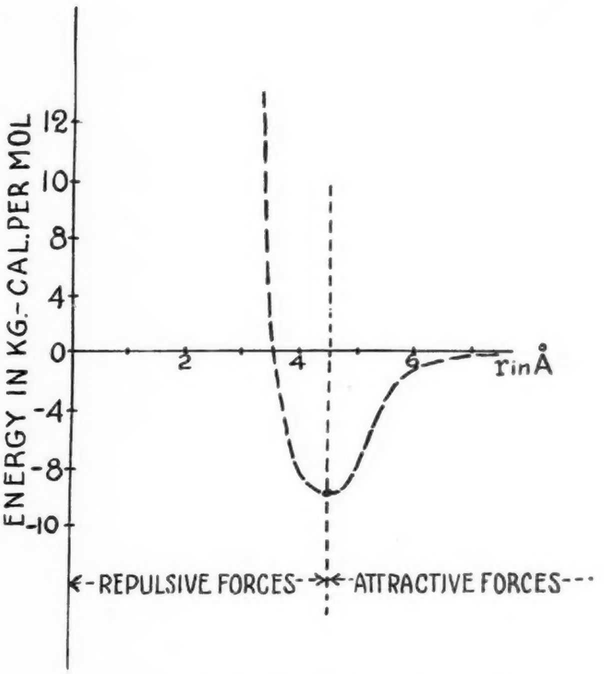

Fig. 1. Potential Energy Curve Representative of Intermolecular Forces Active in a Long Chain Molecular Material

The interaction between two methyl groups assumed to belong to two chains in a sample of natural rubber will be considered in relation to the curve shown in Figure 1. If the centers of these groups (which are the same as the atomic nuclei of the carbon atoms) are at a distance, r, greater than 6 Å from each other, no appreciable interaction takes place. In this range the distance is so great that the potential energy is unaffected by it, and hence no forces prevail between the two groups. Reducing the distance, however, a range is entered in which the potential energy decreases as the groups approach each other, resulting in attractive forces. At approximately $r=4.5$ Å the energy reaches its minimum value which corresponds to the equilibrium position between the two adjacent groups. Upon further approach of the two groups the energy increases rapidly, and strong repulsive forces are obtained.

Thus the energy curve of Figure 1, covering the complete interaction of the two methyl groups, can conveniently be divided into two ranges, one in which the *attractive* forces prevail, and the other in which *repulsion* plays the outstanding role. But the behavior in each range is the result of the same type of interaction.

The next step to be undertaken is analogous to the step made in passing from the theory of an ideal gas to the description of the behavior of a real gas. Van der Waals has carried out this step by introducing two "corrections"; the van der Waals force constant a and the covolume b. They correspond to the attractive and repulsive forces discussed above and are therefore in reality not two independent "corrections," but merely two different results of the same cause: namely, an intermolecular potential of the type described above. (Figure 1.) Thus such corrections must be introduced into our theory of rubber elasticity. Two possibilities must be kept in mind: (a) the forces between two groups belonging to the same chain; (b) the interaction between different chains.

In regard to (a), if two groups of a flexible and kinked long chain molecule are at a distance of 4 to 5 Å from each other, they will attract each other and will therefore tend to contract the chain. Each macromolecule exhibits a force similar to that of an internal van der Waals attraction potential, which result in a phenomenon that may be regarded as a type of surface tension. The chain curls up and assumes a cluster-like configuration. Apparently this action of the molecular forces adds to the kinetic effect discussed in Part I and tends to shorten a chain if it has been extended by external forces. Two theories of rubber elasticity have been based on this consideration. H. Fikentscher and H. Mark[4] have assumed that forces between the —CH=CH— groups in the rubber chains are responsible for this intramolecular surface tension, but later E. Mack[5] has shown that it is more probable that the forces between the hydrogen atoms, which substitute the chains, are larger and therefore will come into action first. It is difficult to say to what extent such an intra-

[1] Formerly with Canadian International Paper Co., Hawkesbury, Ont., Canada; now adjunct professor of organic chemistry, Polytechnical Institute of Brooklyn, Brooklyn, N. Y.
[2] INDIA RUBBER WORLD, 102, 3, 41 (1940).
[3] See J. C. Slater and J. G. Kirkwood, *Phys. Rev.*, 37, 682 (1931).
[4] *Kautschuk*, 6, 2 (1930).
[5] *J. Amer. Chem. Soc.*, 56, 2757 (1934).

molecular attraction contributes to the elasticity of rubber in the first part (A) of the extension curve shown in Figure 1, Part I; it would support the entropy effect, but would show a widely different dependence upon temperature. A careful study of the thermo-elastic behavior at very low elongations would help best to clear up the situation.

In regard to (b), if two atomic groups (CH_2, CH_3, etc.) of two different flexible chains are at a distance of about 5 A from each other, they will equally attract each other and tend to bring the chains nearer together. This leads to the formation of orientated regions and results in the crystallization of rubber under stretch.

Since J. R. Katz[6] first showed in 1925 that stretched rubber produces a sharp and intensive fiber diagram, this effect has been repeatedly investigated,[7] and quite recently very important quantitative contributions have been made by S. D. Gehman and J. E. Field[8] and by G. L. Clark and his collaborators.[9]

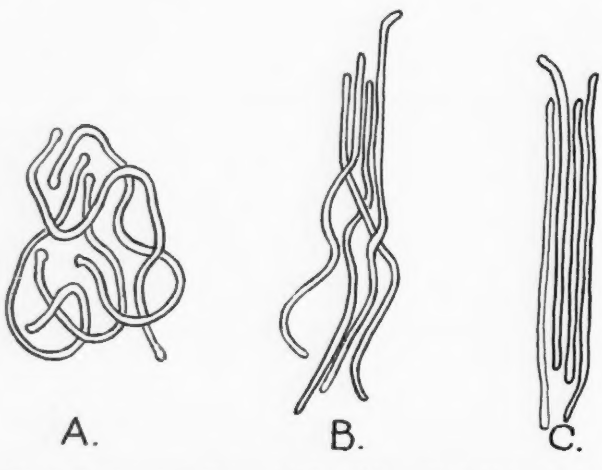

Fig. 2. Diagrammatic Representation of Long Chain Molecules in Three Consecutive Stages of Extension

From our present knowledge the following explanation of this intermolecular behavior is deduced. As soon as the external forces have succeeded in unfolding the curled and entangled chains to a certain extent by overcoming the decrease in entropy and the internal attraction of the molecules, the intermolecular attraction brings certain parts of different chains together, grouping and bundling them. Figure 2 shows diagrammatically molecular chains in three states: (A) entirely unoriented and randomly entagled; corresponding to the range A of Figure 1, Part I; (B) partially crystallized and partially unoriented; corresponding to range B of Figure 1, Part I; (C) entirely crystallized; corresponding to range C of Figure 1, Part I.

It is not necessary to assume that an individual chain is either crystallized or amorphous, but it is very probable that certain parts of the same chain belong to crystallized areas, others to unoriented ones. Experiment shows that stretching produces crystallization; while subsequent contraction causes fusion of the crystals again. Thus we have a reversible[10] process which may be treated with the aid of thermodynamics.

From the foregoing it may be concluded that the introduction of intermolecular forces in the case of rubber leads to the same result as in the case of a gas: namely, to the formation of a new, more highly condensed phase. The *condensation* of a real gas by pressure and the *crystallization* of long chain molecules by stress are apparently analogous processes and should be treated in an analogous way.

The Clapeyron-Clausius equation combines the vapor pressure, p, of a liquid phase with the heat of condensation, λ, the difference of the specific volumes ΔV, and the absolute temperature T as follows:

$$\frac{dp}{dT} = \frac{\lambda}{\Delta V} \cdot \frac{1}{T}$$

If the procedure, as carried out in Part I, is continued, dp must be replaced by $(-d\sigma)$ and ΔV by Δl. Then the following equation is obtained:

$$\frac{d\sigma}{dT} = -\frac{\lambda}{\Delta l} \cdot \frac{1}{T} \tag{1}$$

This relation should describe the co-existence of the two phases (crystalline and amorphous) and may therefore be interpreted as the equation of the melting curve of rubber crystals. By confining ourselves to a comparatively narrow temperature range in the neighborhood of the melting point, λ may be considered to be independent of temperature, and equation (1) can be integrated to give

$$\sigma = -\frac{\lambda}{\Delta l} \cdot \ln T_s + \text{constant} \tag{2}$$

T_s being the melting temperature of the rubber crystals at a given tension σ and the corresponding elongation Δl. Equation (2) can be checked experimentally. Several authors[11] have measured the melting point (or melting range) T_s of rubber crystals at different and Δl values so that λ can be calculated from equation (2). In this way one gets for λ a value of about eight calories per gram; while direct calorimetric measurement gave values between five and ten calories per gram. This can be taken as fair experimental support of the above theory.

To summarize: the second elementary process during the elongation of a rubber-like compound is a type of crystallization which can be described approximately by equations (1) and (2).

During the actual extension of a macroscopic rubber sample the unfolding of entangled chains (process one) and the crystallization of the stretched parts of the chains (process two) apparently proceed simultaneously, and what is observed experimentally is the *composite* behavior.

If *only* process one were effective, the extension curve (for a sample of one gram) would follow equation (3).

$$\Sigma_1 = \frac{Z}{\rho} \cdot k' T \Delta l \tag{3}$$

$\frac{Z}{\rho}$ being the number of chains per gram.

Z = the number of chains per cubic centimeter
ρ = density

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[6] *Chem. Ztg.*, 49, 353 (1925).
[7] See R. Houwink, "Elasticity and Plasticity," Cambridge, 1937, p. 176.
[8] *J. Appl. Phys.*, 10, 564 (1939); contribution at the A. C. S. meeting in Cincinnati, April, 1940; abstract in INDIA RUBBER WORLD, 102, 1, 61 (1940).
[9] *Radiology*, 30, 180 (1938); contribution at the A. C. S. meeting in Cincinnati, April, 1940; abstract in INDIA RUBBER WORLD, 102, 1, 61, (1940).
[10] It should be pointed out that the degree of reversibility depends largely on the material involved, and that owing to plasticity a strict reversibility is never actually reached.
[11] See H. Mark and G. v Susich, *Koll. Z.*, 46, 11 (1928); E. A. Hauser and P. Rosbaud, *Kautschuk*, 4, 12 (1928); G. v. Susich, *Naturwissenschaften*, 18, 915 (1930); P. A. Thiessen and W. Wittstadt, *Z. Physik. Chem.*, B, 29, 359 (1935); M. Iguchi and F. Schossberger, *Kautschuk*, 12, 193 (1936); W. L. Holt and A. T. McPherson, *Natl. Bur. Standards*, 17, 657 (1936); C. J. B. Clews and F. Schossberger, *Proc. Roy. Soc. A.*, 164, 491 (1938); S. D. Gehman and J. E. Field, *J. Appl. Physics*, 10, 564 (1939); W. Lotmar and K. H. Meyer, *Monatsh.*, 69, 115 (1936); H. A. Morss, *J. Amer. Chem. Soc.*, 60, 237 (1938).

If *only* process two were effective, the extension curve would be given by equation (4).

$$\Sigma_2 = -\frac{\lambda}{\Delta l} \cdot \ln T_s + \text{constant} \tag{4}$$

λ being the heat of fusion per gram.

During an actual experiment, where both processes run simultaneously, the sample of the substance may be divided into two parts at any given time as follows: (a) part α, in which the chains are still curled up and hence obey equation (3); and (b) part (1-α), in which relation (4) holds. The total tension in the sample may therefore be represented by

$$\Sigma = \alpha\Sigma_1 + (1 - \alpha)\,\Sigma_2 \tag{5}$$

wherein α, of course, depends on the elongation.

No elaborate mathematical evaluation of (5) is yet available, and it is beyond the scope of the present article to develop this equation further, but it can be shown that the general character of the extension curve in Figure 1, Part I, in the range where A and B overlap is at least qualitatively explained by an equation of the type (5).

In the expression $\alpha\Sigma_1$, the tension increases as the elongation increases; while in the expression $(1\text{-}\alpha)\Sigma_2$, the stress and the elongation are inversely proportional. This means that the unfolding of the chains of a molecule has to be carried out by external stress; while crystallization proceeds without such stress, and the sample is even extended during crystallization without external influence. Therefore the smaller α becomes, and hence the larger (1-α), the less stress is required to produce a given elongation. As a matter of fact, the extension curve bends toward the axis of abscissas, which shows that as the elongation increases, the sample becomes more susceptible to the external force than it was at the start of the experiment.

The fact that the crystallization supports extension has been confirmed recently in a very convincing manner by W. L. Holt and A. T. McPherson[12] and Gehman and Field,[13] and it can be demonstrated by a simple experiment. A thin band of slightly vulcanized rubber is extended to about double its length and attached by two thumb tacks to a small piece of wood. There is a certain tension σ in the sample, a certain amount of which is now crystallized. If the stretched sample is cooled by placing it in a cooling liquid, an additional crystallization is produced, and obeying equation (4), an additional elongation is produced. Removing the sample from the cold bath, it no longer appears to be under tension, but lies loosely between the two thumb tacks, proving that the increased length has been obtained. X-ray diagrams show that the crystallized portion of the rubber has been increased. In this experiment the initial stretch of about 100% serves to create a certain number of small crystals, which act as crystallization centers upon reduction of the temperature. Starting at these centers, a linear crystal growth parallel to the direction of stress takes place and extends those portions of the chains which have not yet been stretched. Thus the molecular attraction between adjacent chains promotes elongation.

A similar behavior in the case of cellulose acetate films, which has been called "spontaneous extension," was observed recently by E. Freund and F. Deutsch.[14] Upon removal of residual solvents from orientated cellulose acetate films, elongations of as high as 100% have been obtained without external influence. This phenomenon is analogous to the crystallization discussed above, with the removal of the solvent from the cellulose acetate creating an effect similar to that caused by the lowering of the temperature in the case of rubber.

Unfolding of chains and formation of crystals are the two processes which dominate the first part of range B in Figure 1, Part I. Upon further extension and crystal growth, a large amount of the external force will be used in stressing the crystals themselves. In this way the third elementary process, *crystallite elasticity,* enters the picture of rubber elasticity.

The Elasticity of the Crystallized Phase

It is not difficult to obtain experimental evidence on the behavior of fully crystallized rubber. If a sample of raw or slightly vulcanized rubber is stretched up to 1000% elongation, an X-ray diagram shows that a large part of the material has crystallized, and only a very faint amorphous ring indicates the presence of a small percentage of entangled, curled chains. If the sample is kept long enough in this state, it loses its ability to contract and remains in the extended state, even if the external force ceases to act.

Such an "overstretched" rubber represents, more or less, the behavior of pure rubber crystals. It is a very hard and tough substance, having elastic extensibility of about 1% and an elastic modulus of 10^{10} dynes per sq. cm. Thus it behaves similarly to those crystallized materials shown in Table 1, Part I, and it is therefore reasonable to assume that the molecular mechanism of extension and contraction in the case of rubber, crystallized by stretching, is the same as in the case of all other highly crystallized substances. Crystalline behavior may be explained as follows. In each crystal the atoms, ions, and molecules are arranged at the points of a three-dimensional lattice structure and carry out quick and irregular vibrations in respect to their equilibrium positions. These positions are dictated by the interatomic, interionic, and intermolecular forces, which act between the elementary particles and hold the crystal together. If such a crystal is stretched, the molecules are pulled away from their equilibrium positions against the action of the mutual attractive forces which are present, thus increasing the internal energy of the crystal. This energy excess is stored within the crystal as elastic energy. As soon as the external forces cease to act, the crystal tends to assume the state of minimum energy and returns under the action of the intermolecular forces to its initial state. As the radius of action of the molecular, atomic, or ironic forces is very short, from 1 to 4 Å, only small displacements of molecules can take place under stress.

If the crystalline material is an organic compound and especially if built up by hydrocarbon chains, it is probable that the stretching of such chains first consists in increasing the tetrahedral angle between subsequent carbon bonds, followed by additional stretching of the C-C main valence linkages at higher strains. The main valence bonds are resistant to extension; while the valence angles, which are far more flexible, are more easily stretched.

Crystal elasticity has a modulus which decreases with increasing temperature and is characterized by the fact that the internal energy increases with elongation.

Composite Elasticity

Reviewing the foregoing discussion in Parts I and II, we may summarize as follows. The total elastic behavior of long chain highly polymeric compounds is of a complex character; at least three different elementary proc-

[12] *J. Res. Natl. Bur. Standards,* 17, 657 (1936).
[13] *J. Appl. Phys.,* 10, 564 (1939); *Chem. Revs.,* 26, 203 (1940).
[14] *Rayon Textile Monthly,* 21, 40 (1940).

esses contribute to it; they are not distinctly separated from each other during extension, but overlap each other over a longer or shorter range of the extension curve.

Unstretched highly elastic materials consist of long chain molecules which may be branched and have accidental (but not too frequent) cross linkages. The molecules are in an unoriented and random state (Figure 2 A). These chains have a certain internal flexibility, and owing to their internal energy content there will be an appreciable amount of intramolecular rotation and oscillation within such a material, which represents, from this point of view, a certain type of transition state between solid and liquid.

The application of stress to such a substance will tend to unfold and straighten certain parts of its chains. Two effects will oppose such an internal change: (a) the decrease of entropy taking place as the chains are brought into the extended state, and (b) the increase of energy resulting from the necessary overcoming of a certain amount of internal surface tension of the chains. The temperature dependence of the elastic modulus offers a possibility in estimating in what proportion these two effects contribute to the total behavior. It appears that the internal attraction between different parts of the same chain affects the total behavior only at the very lowest elongation. Following this, the entropy effect becomes the overwhelming factor. This refers to region A of the curve in Figure 1, Part I, and for the sake of simplicity the entropy effect alone has been considered in equation (3).

As soon as the chains in any part of the material have reached a partially stretched state (Figure 2 B) and conditions become favorable for mutual orientation, crystallization sets in, and the next elementary process comes into play. In other sections of the material, of course, the chains are still wound up and entangled and therefore act as described above. Thus there is a simultaneous functioning of two different elementary processes in different parts of the material.

With increased elongation more crystallized sections are produced which utilize more of the applied stress. As these sections exhibit normal crystal elasticity, they render the material harder and stiffer, much in the same way as does the addition of a crystallized filler such as zinc oxide or carbon black.

Valko[15] has expressed this situation by saying: "Rubber if stretched becomes reenforced by the automatic appearance of a highly active filler, namely rubber crystals."

The different stages of stretched rubber can be compared with unstretched samples containing different amounts of zinc oxide or graphite or with cellulose esters.

While the crystals reenforce the structure in certain sections, other parts of the material are still uncrystallized and extensible. The total behavior is given by a combination of the different processes involved, and the extension curve rises rapidly as region C is approached in Figure 1, Part I.

In the last few years several articles have been published,[16] which follow the formation of the crystallized phase of X-ray diagrams and at the same time measure the mechanical and thermo-elastic behavior. These results prove from a qualitative point of view the existence of the different elementary processes discussed above. But it should be emphasized that more quantitative work must be done in order to explain in detail what actually happens in the different phases of the extension curve.

The conceptions put forward in this short review should only be considered as being a working hypothesis, the main use of which may be to suggest further experiments necessary to obtain a more detailed picture. With this in view the following equation for the extension curve is proposed.

$$\sigma = (AT + CT^{-1})\,\Delta l + B \ln T\,\Delta l^{-1} + DT^{-1}\Delta l^2 \qquad (6)$$

A suitable molecular theory should enable the quantities A, B, C, and D to be calculated, both in regard to their absolute value and their dependence on the elongation. A and B can be represented to a certain extent by using equation (5). C is representative of the elasticity which involves the unfolding of the chains at the beginning of extension and the stretching of the rubber crystals. D summarizes all elastic effects which are proportional to the square of the elongation. It cannot be determined yet to what extent the different elementary processes contribute to this relation, but it is hoped that future experimental work will aid in answering this question.

Other Influencing Factors

It may be helpful to add some remarks concerning internal mobility and regarding hysteresis and plastic flow.

It is a generally accepted fact that the elementary particles of a crystal vibrate around certain equilibrium positions, without undergoing any further movement or displacement. This has been confirmed by the X-ray investigation of many crystallized compounds. But in some cases, especially if long chain compounds are involved, it has been found that the carbon chains rotate as a whole about their long axis. This shows that even in a solid, well-shaped, and rigid crystal a considerable amount of molecular mobility prevails. In the case of fatty acids, the comparatively high mobility of the chains in the crystal lattice makes possible the co-existence of a series of polymorphic modifications, which results in interesting behavior of the material at temperatures in the neighborhood of the melting point.

Another indication of the high mobility of longer sections of chain molecules is indicated in the X-ray dagram of rubber, and another was found during the investigation of the dielectric behavior of different high polymers. When such materials as chlorinated rubber, neoprene, or polyvinyl chloride[17] are placed in an electric field, not only the dipoles which are attached to the chain become orientated, but at the same time larger sections of the chains which bear the dipoles also become moved from their normal position.

W. Kuhn[18] has shown that it is not at all necessary to assume completely free rotation about the carbon-carbon bond, which would contradict recent measurements of Kistiakowsky and his collaborators,[19] but that the existence of a certain amount of internal mobility is sufficient for the production of elastic behavior and this assumption does not conflict with any other well-established property of such materials.

It is known that rubber-like substances show very peculiar hysteresis effects. Some of these appear to be connected with the crystallization process. When a highly elastic material is stretched, the X-ray diagram discloses interference spots which disappear upon release of the material. From this it may be concluded that crystals

[15] H. Mark and E. Valko, *Kautschuk*, 6. 120 (1930).

[16] See W. L. Holt and A. T. McPherson, *J. Res. Natl. Bur. Standards*, 17, 659 (1936); P. A. Thiessen and W. Wittstadt, *Z. Physik. Chem.*, *B*, 41, 33 (1938); H. Hintenberger and W. Neumann, *Kautschuk*, 14, 77 (1938); S. D. Gehman and J. E. Field, *J. Appl. Physics*, 10, 564 (1939); E. Wohlisch, *Kolloid Z.*, 89, 239 (1939); furthermore the contributions of G. L. Clark and S. D. Gehman at the Cincinnati meeting of the A. C. S. in April, 1940,; abstract in INDIA RUBBER WORLD, 102, 1, 61 (1940).

[17] J. M. Davies and W. F. Busse, contribution at the Cincinnati meeting, of A. C. S., in April, 1940; abstract in INDIA RUBBER WORLD, 102, 1, 62 (1940).

[18] *Angew. Chem.*, 52, 289 (1939).

[19] G. B. Kistiakowsky, J. R. Lacher and F. Stitt, *J. Chem. Phys.*, 6, 407 (1938), 7, 289 (1939).

formed during extension melt upon subsequent contraction. This is certainly true, but it appears that after such a cycle has been completed, a certain number of crystallization centers remain intact, and as a consequence the same sample, if extended again, crystallizes more readily than previously. In other words, the coefficient B in equation (6) is dependent upon how often the sample has been stretched. Effects, which appear to have connection with this phenomenon, have been observed by Hauk and Neumann.[20]

Finally it should be emphasized that in all high polymeric materials a certain amount of plastic flow takes place during extension, which affects the physical behavior of the material and should be taken into account if the experiments are carried out so slowly as to allow the plastic flow to produce a measurable elongation.[21]

Conclusion

This short comprehensive review points out that rubber elasticity is a very complicated effect. To obtain a clear picture of this phenomenon, it should be divided into its different fundamental steps, and an attempt should be made to evaluate each step quantitatively. In the present state of our knowledge, at least three such elementary processes can be distinguished and to a certain extent represented quantitatively. However more experimental information on the behavior of highly elastic materials should be obtained in order to determine the correct combination of these elasticity steps and thus to explain satisfactorily the actual behavior of a rubber-like material.

[20] *Monatsh.*, 72, 32 (1938).
[21] See W. Kuhn, *Angew. Chem.*, 52, 289, (1939); H. Dostal, *Monatsh.*, 71, 144, 309, 346 (1938).

Corrections

In Part I of this article, which appeared in our June issue, the following corrections have been noted:

Page 43. In Figure 1 the X-ray diagrams for mixed and crystalline phases should be interchanged. Also in Figure 1, the equation for the extension curve for region B of the curve should read.

$$\sigma = -\frac{\lambda}{\Delta l} \cdot \ln T_s + \text{const.}$$

Silene—A Pigment with Reenforcing Properties

SILENE, precipitated calcium silicate, is a white reenforcing pigment developed by The Columbia Alkali Corp., New York, N. Y., and now being distributed to the rubber industry by the Standard Chemical Co., Akron, O., Silene is said to impart to the finished product: high modulus, high tear resistance, low permanent set, oil resistance, and resistance to abrasion and flex cracking. It is recommended for heels and soles, refrigerator gaskets, tiling, tubing, druggists' sundries, automotive products, plumber's supplies, garden hose, tires, tubes, footwear, etc. Also it is claimed that this material gives the same properties to synthetic rubber as it does to natural rubber.

Silene has a specific gravity of 2.05, a bulk density of 15 pounds per cubic foot, and a particle size of 0.2 to 0.3 micron. Compatible with all known fillers, it mixes readily with rubber, and a large amount may be incorporated in the batch without any processing difficulty, it is said. Any type of acceleration may be used with Silene, and it does not absorb the accelerator. Rather than a retardation of cure, a slight acceleration is produced.

Two formulas, A and B, one containing Silene and the other magnesium carbonate, are presented below, together with physical test data.

	A	B
Smoked Sheets	100	100
Silene	150	...
Magnesium Carbonate	...	150
Zinc Oxide	10	10
Stearic Acid	3	3
Sulphur	3	3
Captax	1	1
Specific Gravity	1.422	1.456
Minutes to Incorporate Pigment	15	21
Total Batch Time (Minutes)	30	40

Cure Min. @ 40 Lbs	200% Modulus	Tensile Strength	% Elongation	Permanent Set	Hardness
		Compound A			
10	1250	1600	290	22	90
20	1260	1480	255	22	92
30	1180	1490	283	26	95
45	1030	1390	320	30	95
60	980	1260	325	33	95
75	860	1130	327	38	95
		Compound B			
10	No Cure				
20	No Cure				
30	No Cure				
45	1020	1570	355	72	80
60	1010	1250	293	58	80
75	1020	1630	385	69	80

The following compounds (C, D, E, and F) are presented, together with physical test data which compare Silene with precipitated calcium carbonate, channel black, and clay:

	C	D	E	F
Rubber	100	100	100	100
Sulphur	3	3	3	3
Stearic Acid	2	2	2	2
Zinc Oxide	6	6	6	6
D.P.G.	0.75	0.75	0.75	0.75
Silene	20 Vol.	..	..	..
Precipitated Calcium Carbonate	..	20 Vol.	..	..
Channel Black	..	..	20 Vol.	..
Clay	..	..	..	20 Vol.

Cure Min. @ 290° F.	500% Modulus	Tensile Strength	% Elongation	Permanent Set	Hardness	Tear
			Compound C			
10	2000	3375	645	30	50	36
20	2500	3475	600	34	53	41
30	2600	3600	615	35	54	38
60	2500	3300	565	36	58	35
			Compound D			
10	575	1650	750	25	40	7
20	990	2350	685	22	45	9
30	1258	2600	645	21	48	11
60	1550	2800	600	23	53	14
			Compound E			
10	1642	2100	575	25	46	32
20	2617	3152	555	25	51	45
30	3242	4000	575	33	53	48
60	3800	4400	525	42	57	52
			Compound F			
10	1321	1671	570	77	44	9
20	2100	2480	550	55	47	11
30	2604	2860	535	50	50	11
60	....	2875	465	50	55	12

Rubber and Cork Soling

A rubber and cork composition soling, manufactured by The O'Sullivan Rubber Co., Inc., Winchester, Va., is sold under a variety of trade names, including: Kortex, Suede-Kork, Cre-Kork, and Tor-Kork. The composition is prepared in the same manner as an ordinary rubber compound; in this case granulated cork of varying gage is used as a filler. The soling is particularly adaptable to use on play and sport shoes. Advantages are said to be excellent wearing qualities and low weight.

EDITORIALS

Our Crude Rubber Reserve

ON PAGE 42 of this issue appear some important facts regarding the Rubber Reserve Co., recently formed to supplement the barter rubber stocks, and the verbatim agreement with the International Rubber Regulation Committee which is the basis upon which the Rubber Reserve Co. was established. As a result of government action, during which members of the rubber industry have been consulted, plans have been made which are intended to provide 85,000 tons of barter rubber, 150,000 tons to be held by the Rubber Reserve Co., and at least 150,000 tons of regular United States stocks in the hands of manufacturers, dealers, etc. Thus provision is made for a total stock of 385,000 tons in this country in addition to which the customary rubber afloat, estimated at 119,138 tons on June 30, 1940, may be considered as ultimately available. Accordingly, after the accomplishment of this program approximately 500,000 tons of crude rubber would be assured in the event that shipments were to cease. This would constitute a quite favorable situation in view of the 592,000 ton consumption in 1939 and our ability to manufacture and substitute for crude rubber a higher percentage of reclaimed rubber and synthetic rubbers, thus prolonging the consumption period for a given quantity of crude.

Even though at this time it is not possible in this country to replace immediately all crude rubber with reclaimed rubber or so-called synthetic rubbers, a very appreciable substitution can be made in a relatively short period. Many materials are now in production, with some excess capacity available or quickly attainable which can be used to replace rubber for more specialized purposes where the factors of cost and service are such that the economy will not be seriously affected. Numerous others can be developed through minor variations in the raw materials or the production processes.

At the end of June 28,365 tons of barter rubber had been received in this country, leaving a balance of 56,635 tons yet to be received. Reports indicate that all of this balance has been bought by the British government and is expected to be shipped by September 1, 1940.

The minimum accomplishment set by the Rubber Reserve Co. of 100,000 tons delivered or afloat by December 31, 1940, plus the balance of approximately 56,000 tons of barter rubber, will require shipments in excess of United States consumption, of 156,000 tons between July 1 and December 31, 1940.

Assuming that there will be ample production of crude rubber and that world consumption for the second half of 1940 will be the same as for the first six months and assuming further that the United States is permitted to absorb the entire production in excess of actual foreign consumption, estimated statistics indicate a very good probability of our obtaining the contemplated reserves. During the first six months of 1940 under an 80% release of basic quota there was an increase of approximately 42,000 tons in U. S. stocks, 29,000 tons in other world stocks, and 49,000 ton in world afloat rubber. Supplementing this 120,000 tons increase in six months under the 80% quota, an additional 38,500 tons should result from the increase from 80 to 85% in basic quota for the last six months, and an increase of 15,000 tons is expected from unrestricted territories. This would provide for an excess of 173,500 tons, which may reasonably well be expected to be available to accommodate the requirements of 156,000 tons to complete by December 31, the minimum projected plans for a rubber reserve in this country. In other words, if these conditions and assumptions become facts throughout the last half of 1940, a maximum of 117,500 tons of rubber will be available for the Rubber Reserve Co. by the end of the year.

The above analysis of conditions indicates a possibility of accomplishment, but should not be construed as insuring the activation of plans into fact. In contradiction to this optimistc view is the performance under the barter agreement to exchange American cotton for 85,000 tons of rubber which was signed on June 23, 1939. Necessary Congressional legislation was approved on August 11, 1939 The British government was to purchase the rubber and to undertake to arrange with the International Rubber Regulation Committee the provision of sufficient supplies to enable completion of the purchases of rubber by March 31, 1940. This date of completion was later extended to June 30 and again to September 30, 1940. At the end of approximately one year from the consummation of the barter agreement, less than 30,000 tons of the anticipated rubber was actually in this country.

In the instance of the intended accumulation by the Rubber Reserve Co., the agreement has been made directly with the International Rubber Regulation Committee, thus eliminating contact through the British government as was the condition in the barter agreement. The actual buying is to be done by the Rubber Reserve Co. on the open market at 18¢ to 20¢ per pound.

This arrangement tends toward simplification and should expedite accomplishment. It is to be hoped that close cooperation between the Reconstruction Finance Corp. and rubber manufacturers will prevail in the management of the Rubber Reserve Co. so as to act as an insurance against any such retardation of the physical procurement as has been experienced in the instance of the barter rubber.

The plans for providing a reserve supply of rubber are excellent. The efficient execution of these plans is yet to be demonstrated.

S. C. Stillwagon

EDITOR

What the Rubber Chemists Are Doing

Committee D-11 Active at A.S.T.M. Meeting

THE 1940 annual meeting of the American Society for Testing Materials, held in Atlantic City, N. J., June 24 to 28, had a registered attendance of 1,441, exceeded in the past only by the New York, N. Y., attendance of 1,523 in 1937. W. M. Barr, of Union Pacific Railroad Co., succeeded H. H. Morgan, of Robert W. Hunt Co., as president of the society; H. J. Ball, of Lowell Textile Institute, was chosen vice president to serve with G. E. F. Lundell, of National Bureau of Standards, elected vice president in 1939.

Committee on Rubber Products

The report of Committee D-11 on Rubber Products, submitted by O. M. Hayden, chairman, included four new tentative standards which were approved at the meeting. Two of these were developed by Technical Committee A on Automotive Rubber, joint S.A.E. and A.S.T.M. committee: testing automotive hydraulic brake hose and test for compression-deflection characteristics of vulcanized rubber. The testing requirements for brake hose cover: volumetric expansion under pressure, bursting strength, fatigue life, and tensile strength. Two procedures are involved in determining compression-deflection characteristics: one in which the load required to cause a specified deflection is determined; the other in which the specified weight or compressive force is placed on the specimen, and the resulting deflection is measured. The two other new tentative standards cover tests for accelerated aging by the oxygen-pressure methods at 80° C. and specifications for ozone-resistant insulation.

Five tentative standards are to be referred to the society ballot for adoption as standard: abrasion resistance (D 394 - 37T), modified by the elimination of tests by certain machines; accelerated aging (D428-36T), by which the existing standard is to be separated into two items, one oxygen-pressure-chamber method, the other the oven method; test for flexing (D 430 - 35T); air pressure heat test (D 454 - 37T); and specifications for rubber gloves for electrical workers on circuits not exceeding 3,000 volts to ground (D 120 - 37T).

Brief reference was made to three new standards, which were approved late last fall and represent the first effective standardization effort in connection with quality control of the materials involved: sponge rubber products; hard rubber products; and rubber cements (viscosity and total solids). The committee expects to submit additional standardization procedures and specifications to the society later this year, one of these to determine tearing resistance, another for calibrating light source, and another for testing rubber specimens under artificial light as part of a life test program.

Lewis Larrick, physical research laboratory, The B. F. Goodrich Co., discussed the standardization of durometers in a technical paper. He referred to a number of the instruments in use and some of the problems involved, including lack of agreement among the instruments. Standardization on one of the durometers which has been in use for several years was discussed.

Committee D-20 on Plastics

The report of Committee D-20 on Plastics included three new tentative standards on: test for flammability, measurement of flow temperatures of thermoplastic materials, and test for water absorption. Two technical papers were also presented: "Accelerated Weathering of Transparent Plastics," by G. M. Kline, W. A. Crouse, and B. M. Axilrod, of the National Bureau of Standards; and "The Absorption of Water by Plastics," by Dr. Kline, Mr. Crouse, and A. R. Martin. Robert Burns, Bell Telephone Laboratories, Inc., described a device which constitutes a simple and inexpensive supplement to the more precise methods of controlling the moldability of plastics. The device is a die, in which a plunger is inserted, employing seven capillaries which have a range of diameters.

The 1941 meeting of the Society will be held in Chicago, June 23 to 27, at The Palmer House.

High Molecular Weight Compounds Discussed Before A.A.A.S.

AS A part of the program of the American Association for the Advancement of Science's meeting last month at Gibson Island, Md., a sectional meeting was held from July 8 to 12 on the subject, "Organic High Molecular Weight Type Compounds," under the chairmanship of H. L. Bender, of the Bakelite Corp. Those presenting papers and their subjects follow: E. O. Kraemer, "The Molecular Tests of Resin Behavior"; E. Ott and H. M. Spurlin, "Discussion of High Molecular Weight Chains"; H. Mark, "The Elastic Behavior of High Molecular Compounds"; W. T. Busse, "The Effect of Temperature and Hysteresis on the Tensile Properties of Rubber in Shear"; B. S. Garvey, Jr., "Mixed Polymers and Vulcanizable Plasticizers"; R. M. Fuoss, "Electrical Properties of Polyvinyl Chloride Plastics"; H. Hetenyi, "Photoelastic Tests with Heat Hardening Resins at Elevated Temperatures"; W. Sesson, "X-Ray Studies Regarding the Structure and Behavior of Cellulose Fibers"; H. Eyring, "Rate Processes Involving Large Molecules."

An active discussion followed the presentation of these papers, which placed emphasis on the experimental methods used in investigating the molecular state of high polymers under two extreme conditions: highly diluted solutions of large molecules and high polymers in the solid state.

The discussion brought out that in order to obtain a complete picture of the molecular state of a material, the following essential points should be considered: the chemical nature of the substance; whether one or more components are present; whether the chains are chiefly long and straight or highly branched; whether active groups are present in the main chains or in the side chains; how flexible the chains are, and to what extent their flexibility is dependent upon cross-linkages. It was held that a solution to these questions can be obtained by experimental methods such as those covered in the papers presented, i.e., shearing and tensile tests, measurements of di-electric constant, X-ray studies, etc. As the commercially important properties of highly polymerized materials are dependent upon the molecular state, such test methods are of particular importance, it was pointed out.

Softeners for Neoprene

TWO materials, Suniso 3A Process Oil and Circo Light Process Oil, are said to be well suited for plasticizing neoprene. Their high compatibility with neoprene will prevent them from blooming to the surface when used in amounts generally required by commercial practice, it is claimed.

Suniso 3A, nearly water white in color, is used where color limitations are placed on the finished neoprene product or in those products where appreciable amounts of discoloring extractable materials are not desired, such as in the case of gasoline hose and non-staining gaskets. Circo, a golden colored oil, has compatibility with neoprene by reason of its high degree of naphthenicity, and is employed where there is no need of color control of the finished product.

Automotive Symposium Program Announced by Rubber Division

AS ANNOUNCED before, the Division of Rubber Chemistry, A. C. S., will hold a symposium on "Rubber, Synthetics, and Plastics in the Automotive Industry as Viewed by the Engineer and Chemist" on September 12 in conjunction with the division's fall meeting, September 12 and 13, in Detroit, Mich.

The symposium papers will be as follows: "The Use of Rubber in the Automotive Industry from the Viewpoint of the Automotive Engineer," C. Smart and G. W. Lampman, Pontiac Motors; "The Use of Rubber in the Automotive Industry from the Viewpoint of the Rubber Technologist," S. M. Cadwell, United States Rubber Co.; "The Standardization and Coordination of Automotive Rubber Parts Specification," L. A. Danse, Cadillac Motors; "The Use of Synthetic Rubber in the Automotive Industry from the Viewpoint of the Automotive Engineer," J. C. Zeder, Chrysler Corp.; "The Use of Synthetic Rubber in the Automotive Industry from the Viewpoint of the Rubber Technologist," J. N. Street, Firestone Tire & Rubber Co.; "The Use of Plastics in the Automotive Industry," W. M. Phillips, General Motors Research.

The banquet committee has announced that W. J. Cameron, of the Ford Motor Co., will be the speaker for this occasion and that the dinner program will include music and various acts between courses. Further details on the fall meeting, including the program of papers to be presented on September 13, will be given here in our September 1 issue.

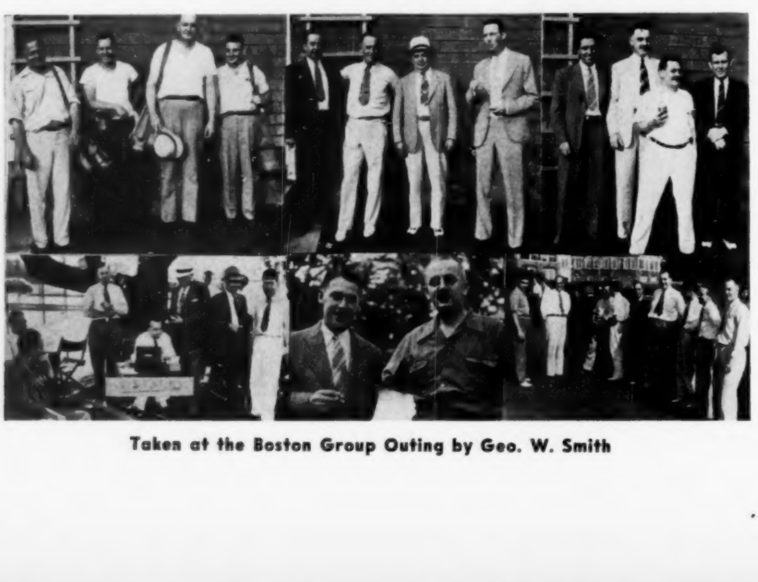
Enjoyable Outing Held by Boston Group

THIS year's outing of the Boston Group, Rubber Division, A. C. S., held at the Weston Country Club, Weston, Mass., July 19, won the enthusiastic approval of the approximately 225 attending. The affair was under the guidance of Joseph L. Haas, outing chairman, and his assistants, J. C. Walton, H. S. Liddick, Emil Krismann, H. P. Fuller, L. R. Clarke, D. D. Wright, and Edward Colligan, to whom much credit is due for their efforts in assuring the success of this annual event.

After a varied sports program which included a golf kickers tournament in which 103 participated, softball, quoits, darts, bowling, and tennis, a dinner of steak or lobster was served to 210 members and guests. The threat of ham and eggs for those who failed to make reservations did not have to be carried out as the response to the outing notice was 84% complete. The evening was climaxed by the distribution of about 200 prizes to sports winners and lucky ticket holders.

The winners in the various sporting events follow: GOLF, *low net*, W. Fish, R. C. Kelley, and C. E. Reynolds; *low gross*, F. F. Salamon, A. Allen, J. Fisher, S. Tinsley, A. Ryan, and W. H. Peterson; *nearest to pin*, R. Lockhead (hole-in-one), G. E. Wilson, and D. Higby; *most 5's*, F. L. Downs; *most 6's*, C. L. Muench; *most 7's*, J. C. Walton; *high gross*, H. A. Atwater; *tennis*, J. H. Clarke; *bowling*, B. Mayo, Jr.; *quoits*, D. Ludquist.

The large and excellent group of prizes was made possible through the generosity of the following: L. Albert & Son, Aluminum Flake Co., American Mineral Spirits Co., American Zinc Sales Co., Ansbacher-Seigle Corp., T. C. Ashley & Co., Archer Rubber Co., Arrow Electric Supply Co., Atlantic Refining Co., American Cyanamid & Chemical Co., Avon Sole Co., Anaconda Sales, S. L. Ayres & Co., William Barrell Co., Barrett Co., Binney & Smith, Boston Woven Hose & Rubber Co., Brooklyn Color Works, Inc., Buck Creek Mills, Inc., Godfrey L. Cabot, Inc., Callaway Mills, Carter Bell Mfg. Co., J. F. Carter & Co., Central Supply Co., Clinton Sales Co., C. F. Church Co., Cleveland Liner & Mfg. Co., Colonial Beacon Oil Co., Continental Carbon Co., Converse Rubber Co., Davidson Rubber Co., Dennison Mfg. Co., E. I. du Pont de Nemours & Co., Inc., William D. Egleston Co., Eustis Pennock Co., Foxboro Co., C. E. Gale & Co., General Atlas Carbon Co., Geneseke Bros., C. P. Hall Co., Haartz-Mason-Grower Co., Hird & Connor, Inc., Hood Rubber Co., Hodgman Rubber Co., Imperial Oil & Gas Products Co., Imperial Paper & Color Corp., Innis Speiden, INDIA RUBBER WORLD, Krebs, Pigment Co., Merck & Co., Merrimac Chemical Co., Metasap Chemical Co., J. W. Morrissey, H. Muehlstein & Co., Inc., Monsanto Chemical (R. S. L.), National Rubber Machinery Co., Naugatuck Chemical Division of United States Rubber Co., New Jersey Zinc Sales Co., Neville Co., Norton Abrasives Co., North & Judd, Oakite Products Co., Pacific Mills, Panco Panther Co., Pequanoc Rubber Co., Philipp Bros., Inc., Pratt & Lambert, J. R. Poole, Plymouth Rubber Co., R B H Dispersions, *The Rubber Age*, Reichold Chemicals, A. Schulman, Inc., A. Schrader Sons Co., Henry L. Scott Co., Sanford Mills, Simplex Wire & Cable Co., Southeastern Clay Co., Walter Strassburger & Co., Standard Ultramarine Co., Stamford Rubber Supply Co., Stewart Bolling & Co., Inc., Stowe-Woodward Co., Inc., Stanley Chemical Co., J. P. Stevens & Co., Inc., Sherwin Williams Co., Sun Oil Co., Sonoco Products Co., Thiokol Corp., William R. Thropp & Sons Co., Titanium Pigment Corp., A. J. Tower, United Carbon Co., Vansul, Inc., R. T. Vanderbilt Co., Vultex Chemical Co., Washburn Co., Weller Chemical Co., Wesco Waterpaints, L. G. Whittemore, Wichnick Tumpeer, Inc., Charles T. Wilson Co., Wolverine Equipment, and Xylos Rubber Co.



Taken at the Boston Group Outing by Geo. W. Smith

Los Angeles Fishing Trip Enjoyed by 43 Members

WHEN the fishing boat, *Retreat*, headed out to open sea from San Pedro, Calif., at 5.15 p.m. on June 21, 43 members of the Los Angeles Group, Rubber Division, A. C. S., were on board. At 8:00 p.m. the boat arrived at Avalon, Catalina Island, where the group disembarked to enjoy an excellent dinner at John's Cafe. After dinner some of the group went sightseeing, a few went back to the boat to fish; while those so inclined turned in to sleep at cottages in the Island Villa.

At 4.15 a.m., June 22, the boat left the Catalina pier for the fishing grounds at the southeast end of the island where the first fish, a blue fin tuna, was brought to gaff at 4.58 a.m. The catch included: one tuna, nine yellowtail, one white sea bass, six barracuda, one sculpin, and ten calico bass. The largest fish, a yellowtail, weighed about 20 pounds. The boat returned to San Pedro at 1.30 p.m., with everyone, except two members of the fishing party who did not feel so well on the return trip, voting the affair one of the best ever held.

The prizes were won as follows: *fish guessing contest,* L. Jung (U. S. Rubber), repeating rifle; *largest fish,* Charles Lamb, Sr. (West American Rubber), fishing outfit; *second largest fish,* R. D. Bonham, (Hoffman Hardware), radio; *greatest number of fish,* Ernest Brazil (Blue Star Mines), thermos set; *first fish,* W. G. Tapping (Cutler-Hammer), picnic case; *last fish,* H. Lewis, clock; *smallest fish,* Fred Woerner (C. P. Hall), split bamboo pole. Other prizes went to: Carl Stentz (Latex Seamless Rubber); Claude Kelly (Goodyear); L. F. MacDonald (Goodrich); H. Dunbar; Newcomb (Goodrich); H. L. Oak; Paul Smith; J. Gardner; J. Hulsey (Kirkhill Rubber); P. Zeidirbrock; V. Vodra (R. T. Vanderbilt); Charles Churchill (Muehlstein); MacNeel Pierce (Kirkhill Rubber); C. H. Vonder Reith (Sierra Rubber); S. Davidson (Goodyear); A. Swanson (W. J. Voit); H. H. Simon (Sears-Roebuck); E. H. Lewis (Western Insulated Wire); J. W. Goodman; G. Maassen (R. T. Vanderbilt); and Harry Kincade (U. S. Rubber).

Added Data on Akron Outing

WE PRESENT here photos and additional information, received too late last month for publication, on the outing of the Akron Group, Rubber Division, A. C. S., on June 14. The affair was the largest ever held by the group at the Silver Lake Country Club, Akron, O.: 250 played golf; while approximately 500 attended the dinner in the evening.

The many valuable prizes distributed at the outing were made available through the donations of the following: American Cyanamid, Akron Chemical, Akron Paint & Varnish, Akron Standard Mold Co., Aluminum Co. of America, American Zinc Sales, Adamson Machine, Anaconda, L. Albert & Son, Binney & Smith, Bridgeport Brass, Bridgwater Machine, Barrett Co.; Barnsdall Oil, Carbide & Carbon, Columbia Chemical, Continental Carbon, Cannon Mills, Continental Rubber, Colonial Insulator, Central Rubber, Carter Bell, Dill Mfg., Dow Chemical, Dugan & Campbell, Eastern Magnesia Talc, Erie Railroad, du Pont, English Mica, Forbes Varnish, Russell Farley, Farrel-Birmingham, Godfrey L. Cabot, General Magnesite & Magnesia, Grasselli Chemical, Herron & Meyer, J. M. Huber, C. P. Hall, International Pulp, Imperial Oil & Gas, INDIA RUBBER WORLD, Manufacturers Rubber Supply, F. F. Myers, Monsanto Chemical, H. Muehlstein, Midwest Rubber Reclaiming, N. J. Zinc, Niagara Sprayer, National Rubber Machinery, National Standard, Naugatuck Chemical, Ozark Smelting, Ohio Sherardizing, Piqua Stone Products, Philadelphia Rubber Works, *Rubber Age,* Superior Zinc, A. Schrader's Son, Shell Oil, Southeastern Clay, Stamford Rubber Supply, St. Joseph Lead, H. S. Stoller, Standard Oil, A. Schulman, Southern Acid & Sulphur, Standard Ultramarine, F. E. Schundler, Stauffer Chemical, Thompson-Weinman, Thiokol, Titanium Pigment, Turner Halsey, United Carbon, Vultex Chemical, C. K. Williams, Charles T. Wilson, Wishnick-Tumpeer, Charles White, Xylos Rubber.

Chicago Group Holds Second Annual Outing

OVER 75 members and guests attended the second annual outing of the Chicago Group, Rubber Division, A. C. S., held at the Lincolnshire Country Club, Crete, Ill., Saturday, July 20. Those attending played golf, and with the temperature at 95° F., a dip in the club's pool was enjoyed by many.

A large measure of the success of this outing was credited to the generosity of the following concerns who supplied 42 prizes for the affair: L. Albert & Son; Godfrey L. Cabot, Inc.; Commerce Petroleum Co.; E. I. du Pont de Nemours & Co.. Inc,; General Atlas Carbon Co.; Herron & Meyer; J. M. Huber, Inc.; International Smelting & Refining Co.; Midwest Rubber Reclaiming Co.; Monsanto Chemical Co.; New Jersey Zinc Sales Co.; A. Schulman, Inc.; Wishnick-Tumpeer, Inc., and United Carbon Co.

Rubber-Wax Protective Compound

CABLES and pipes are protected against corrosion by Suprax, a mixture of unvulcanized rubber, non-corrosive waxes, and fillers. The compound, according to its English manufacturer, can be extruded over seamless pipes and cables to provide a non-corrosive and non-absorbent protective coating of high dielectric strength. It is also said to be unaffected by ultra-violet radiation, ozone, and climatic conditions. A special softened form of Suprax, workable at hand temperatures, is suitable as a sealing and insulating medium for cable joints and ends. The material is also produced in tubing form for covering pipes and cables and in sheet form for electrical purposes or for motor vehicle mudflaps.

Black-Out—A Surface Protective

BLACK-OUT, recently introduced by the R. T. Vanderbilt Co., 230 Park Ave., New York, N. Y., is a pigmented coating material of colloidal nature, used to retard ozone cracking and sunchecking of black or dark colored rubber products. The new surface protective is a dark brown liquid (a solid in a volatile solvent), which upon evaporation leaves an adherent, flexible, non-tacky film of fairly good black color, which, it is claimed, will not crack or flake off when the rubber article is bent, flexed, or twisted. The ability of Black-Out to prevent cracking and deterioration of rubber is said to be retained even when the rubber surface is at or near its critical elongation. Highly absorbent, the new material is also useful in covering up bloom or preventing its appearance. Black-Out films have little, if any, resistance to abrasion and, hence, are impractical for tire treads. Its flexibility, however, permits its advantageous use on tire sidewalls.

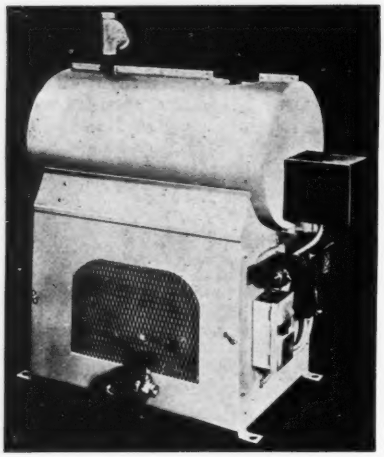
Black-Out may be applied by brushing, dipping, or spraying (diluted with toluol). Dipping or drawing through a tank is preferred for wire insulation or other articles made in lengths. At temperatures of 70° to 90° F., dipped coatings dry sufficiently for handling in about one half hour; sprayed coatings in five to ten minutes. The drying temperature should not exceed 110° F.

Photos courtesy of Akron Rubber Group.

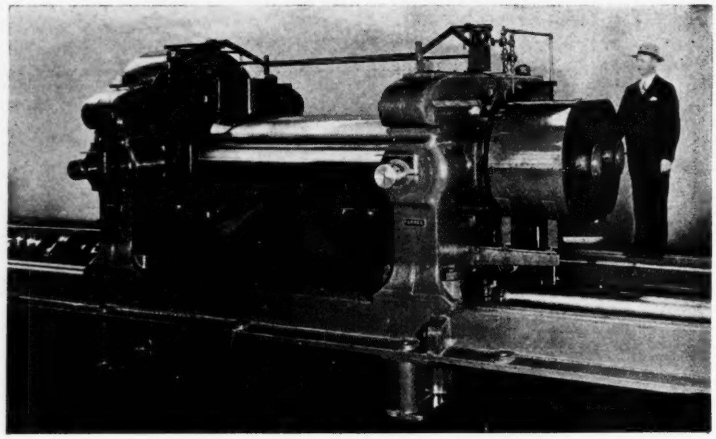
Activities at Akron Group Outing

(*Left to Right.*) *Golf:* A. K. Thayer (C. K. Williams), F. A. Bonstedt (Binney & Smith), and A. E. Warner (C. P. Hall); *Banquet Scene; Relaxation:* C. G. Kiess (National Rubber Machinery), J. R. Strickland (National Rubber Machinery), unidentified, J. H. Hand (Monsanto), J. Littman (Packard Electric), W. Piggott (Goodrich), J. B. Waite (Dugan & Campbell), and W. Williams (Goodrich); *Skeet Shooting:* L. Wolcott (Silver Lake Country Club), R. M. Reel (Pharis Tire & Rubber), J. B. Waite, and T. L. Stevens (C. P. Hall).

New Machines and Appliances



Royle Heating and Circulating Unit



Farrel 28- by 84-Inch Heavy Mill

Heating and Circulating Unit for Extruders and Presses

THE Royle heating and circulating system for oil or other liquid heat-transfer media, which was designed primarily for use with Royle extruders in the plastics industry, may be applied to hydraulic presses and other machines where the use of a positive circulation of thermostatically regulated heat transfer medium is desirable. When in use, the medium employed is maintained at a temperature below its boiling point.

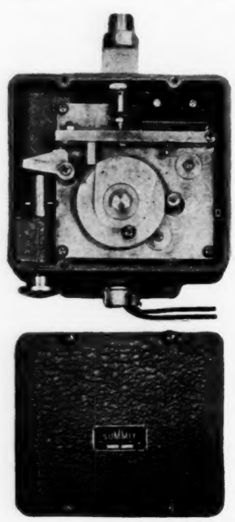
Essentially the standard unit comprises: a tank-type reservoir to hold the liquid medium which is heated by a thermostatically controlled 6,000-watt electric immersion heater (heaters with a capacity up to 11,000 watts are also available); a special motor-driven hot oil pump; oil strainer; and automatic pressure relief valve. The tank is insulated with glass wool, covered with a steel jacket, and mounted on a welded steel frame. The enclosed base houses the motor and pump and is provided with removable side panels for ready access. Interior piping is also insulated; while the tank has a four-inch tank hole for cleaning purposes. The unit is 37 inches high and occupies a floor space of 19 by 36 inches; the tank capacity is 10 to 11 gallons. John Royle & Sons, Paterson, N. J.

Extra Heavy 84-Inch Mill

THE 28- by 84-inch rubber mill illustrated is said to be the largest and the most rugged ever built in this country. It is made from entirely new patterns and incorporates in its design new proportions to achieve maximum strength, with advantage being taken of the newer materials available today. This mill is one of three built primarily as sheeting mills to handle with greater facility the large batches mixed in size 11 Banburys. The three mills arranged in line with a Banbury mounted over each, are driven by a 600 h.p., 514 r.p.m. motor through an enclosed herringbone gear reduction drive. The mills are equally adapted to all other operations performed on roll mills.

The rolls, of Farrel hard chilled iron, 28 inches in diameter, 84-inch face, and with 18-inch diameter journals, are cored and fitted with internal spray pipes and overflow nozzles. The housings are of Meehanite, as are the journal boxes which are fitted with full-circle brass liners. The boxes are water-cooled, are force-feed lubricated from a central system, and have oil seals at both ends. The mills have a safety shear pin on the adjusting screw to prevent mill breakage, and a pull-back, integral with this safety feature, permits adjustment of the rolls forward as well as back. The adjusting screws are of high carbon steel and operate in quickly removable cast steel nuts; while the guides are the standard self-adjusting type and are made of Meehanite.

The connecting and drive gears are of steel with cut spur teeth, and they are enclosed in sheet steel guards and run in an oil bath. Safety bars and switch are provided to apply dynamic braking for emergency stopping. The mills are supported on heavy stringer bed plates of Meehanite. The line shaft is carried in self-oiling pillow blocks, located at suitable intervals and mounted on heavy Meehanite bridge-type girders. Farrel-Birmingham Co., Inc., Ansonia, Conn.

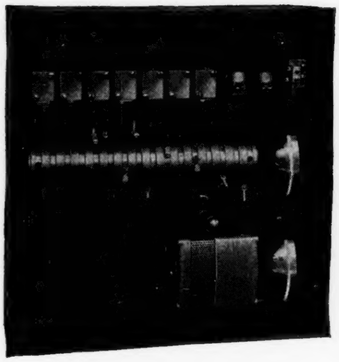


Seely Model T Timer

Automatic Timer Features Simplicity

THE Model T timer is designed for the control of the less complicated cycles of automatic processing. The control of the cycle comprising the closing of a vulcanizing press and its reopening after a definite time interval, together with the bumping of the press for the release of trapped gases, is one application of this instrument in the rubber industry.

The timer, which is said to feature simplicity and ruggedness of design, is motor-operated and cam-acting, with the following standard time ranges: ¾-minute to 3 minutes; 1½ to 6 minutes; 3 to 12 minutes; and 6 to 24 minutes. The instrument is installed simply by connecting its two wires to the electrical supply and by connecting its pilot valve to the air supply and diaphragm valve with copper tubing. To begin a cycle a plunger at the bottom of the timer is pushed upward. Seely Instrument Co., Inc., Akron, O.



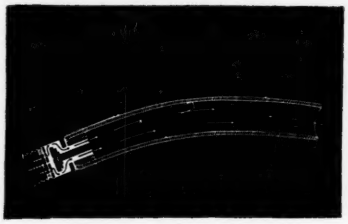
Taylor Flex-O-Timer

Time Cycle Controller

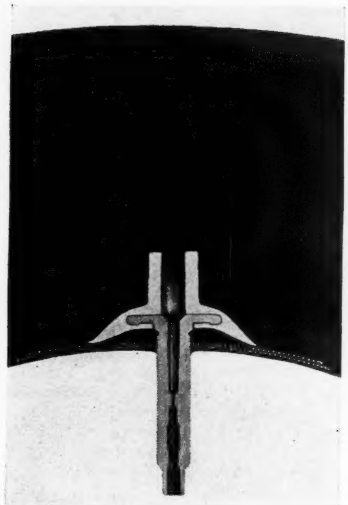
THE Taylor Flex-O-Timer, adaptable for all-electric, all-pneumatic operations, or combinations of both, is said to afford maximum precision in the timing of the sequence and duration of processes which involve temperature, pressure, humidity, or combinations of each.

The revolving drum of the Flex-O-Timer uses adjustable actuating pins. Cam cutting is eliminated, and these actuating pins are easily adjusted in the circumferential undercut grooves on the drum. The air valve or switch can be turned on and off or vice versa, within ½ of 1% of total cycle time by means of this adjustability, it is claimed. The air valve utilizes 99½% of the air passed through it, and the air valve plunger is so designed that the air supply port cannot at any time communicate with the exhaust port, assuring rapid and full air pressure application and release. Because of the valve's large capacity, no auxiliary pilot valves are required.

A new latch-trip solenoid operated mechanism, which starts the process instantaneously, actuates one or more snap operators to start the timer motor and any outside electrical or pneumatic functions to be performed simultaneously at the start of the cycle. The drum is directly run by a spur gear train, but a dog-and-latch mechanism provides 78 different drum speeds with each gear train ratio. Yet the drum speed is fixed and positive for any given settings and can vary only as the freqency of the electrical supply changes. Models are also available with a fixed speed gear train. Taylor Instrument Cos., Rochester, N. Y.



Shut-Off Valve for Cleaner



Valve Section of Airbag equipped with Glycerine Trap

Glycerine Trap for Airbags

A TRAP for full-circle airbags used in retreading is said to prevent the escape of glycerine from the bag no matter what position the valve stem occupies. Retreaders who use vertical molds generally place the valve at the bottom so as to lose as little glycerine as possible. While this procedure is partially effective in retaining glycerine, it keeps the opposite section of the bag out of contact with the liquid. With the new trap the bag stem can be placed in a different position for each heat, to use the glycerine effectively over the entire inner surface of the bag and thus to aid in maintaining the rubber pliable. Firestone Tire & Rubber Co.

Cleaning Device

GREASE, oil, and dirt are removed from motors, engines, and mechanical parts with a cleaning unit that sprays kerosene or other cleaning fluid with compressed air. The unit comprises a fluid injector tube connection in the spray nozzle which is directly connected to the air line. Compressed air flowing through the nozzle sucks the cleaning fluid through a supply hose of neoprene. A unique feature of this device is the shut-off valve, illustrated, which is located at the nozzle end of the hose. Pressure on the stem of this valve starts the flow; while release of pressure stops flow. This shut-off mechanism can also be applied to the nozzle ends of the water hose lines. Lonn Mfg. Co.

Abrasive Wheel Grinds Rubber Without Burning

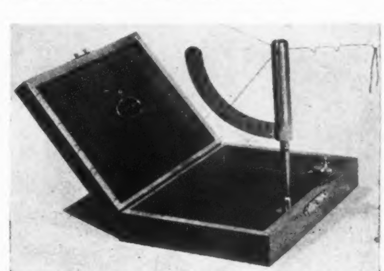
AN ABRASIVE wheel is claimed to grind and buff rubber rapidly without the danger of burning the work or clogging and glazing the wheel.

Cool-Running Abrasive Wheel

The cool-operating quality of the wheel is said to be the result of the methods used in its manufacture rather than the materials employed, which are standard—a resinoid bond and silicon carbide or aluminous oxide, etc., abrasives. Wheels are built in coarse, medium, and fine grain grades and as a combination wheel with one side coarse and the other fine. The combination type is not laminated, but is made by using two sizes of grain in the same wheel. The wheels are made in two degrees of hardness, a soft wheel for grinding rubber and a hard wheel for grinding and buffing leather and similar fibrous materials. The hardness is controlled by a special tempering process. In the rubber industry the wheels are said to be useful for grinding, shaping, and buffing rolls of any density and for other rubber products requiring similar treatment. Atlantic Abrasive Corp.

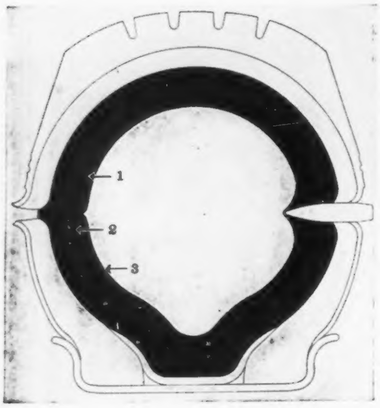
Portable Yarn Count Scale

RUBBER thread, covered or uncovered, as well as textile yarns, tinsel, etc., is tested for size on a portable yarn count scale, particularly adaptable for short lengths. The test merely consists of measuring the length of thread used to balance the scale. This length gives the yarn count directly without further calculation. Samples of yarn or thread weighing as little as 1/25-grain can be tested. For coarse rubber thread a supplementary scale attachment is used. Although it has a sensitivity of 0.025-milligram, the scale is said to be durable and to be capable of withstanding rough usage. After use, the scale may be folded up conveniently in its case. W. A. Le Blanc.



Scale for Counting Rubber Thread

New Goods and Specialties



Machine Gun Bullets Piercing Seiberling Bullet-Seal Tube: 1. Bulkhead Walls of Cured Rubber; 2. Uncured Plastic Sealing Rubber; 3. Thin Ply of Gum, Stiff Enough Not to Be Thrown by Centrifugal Force

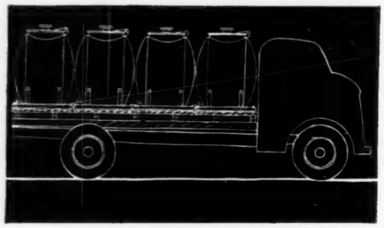
Bullet-Proof Tube

THE Seiberling Bullet-Seal tube employs the same puncture-sealing principle as the firm's Sealed-Air tube for passenger-car service. Both utilize a soft adhesive plastic gum of uncured rubber, supported by bulkheads which consist of inner and outer walls and partitions of cured rubber. While the Sealed-Air tube has only a single layer of bulkheads in the neighborhood of the periphery of the tube, the Bullet-Seal tube has a double layer of bulkheads which line the entire inner surface of the tube. The inner surface is then covered with a thin layer of less plastic gum.

The flexing action of the tire as it rolls over the road kneads the plastic gum in the bulkheads, fusing the gum and thereby sealing the puncture. Heat generated by fast driving softens the plastic gum and increases the tube's puncture-sealing efficiency. The bulkheads prevent the puncture-sealing gum from being thrown toward the periphery of the tube by centrifugal force. The tube is said to withstand successfully burst of shots from 30-calibre and 50-calibre machine guns. The Seiberling Rubber Co.

Removable Rubber Liners for Tanks and Barrels

FORMERLY confined to bleach barrels, Snap-In rubber liners are now being made for all shapes and sizes of metal or wooden tanks, either in the plant or on tank trucks, under U S. patent No. 2,025,932. The advantages claimed for these liners are: accumulated chemical gases forming blisters between tank and liner can be released without puncturing the liner; liners can



Snap-In Lining Installation for Four 250-Gallon Compartments on a Truck Hauling Sodium Hyperchloride

be removed for repairs to the liners or to the tanks; additional liners can be made from the original molds without shipping tanks to and from the factory.

These liners are said to handle satisfactorily at temperatures not exceeding 150° F.; acetic acid up to 80% concentration; ammonia liquor; cadmium cyanide; caustic soda; hydrochloric acid; nickel sulphate; sodium chloride; sulphuric acid, 55% concentration; tannic acid; zinc chloride; and other chemicals. Goodall Rubber Co.

Curb Pump Hose Uses Synthetic Rubber Throughout

IN THE Maltese Cross, all-synthetic curb pump hose, Hewprene synthetic rubber is used throughout the entire hose, including not only the inner tube, but also the ply insulation and the outer cover. According to the manufacturer, tests have shown that this all-synthetic construction gives more than twice the resistance to permeation by gasoline than does hose of the same thickness built of natural rubber with only a synthetic lining.

In these "SRL" pipe fittings of Paramount Rubber Service, Inc., the rubber covering has been built up from the treated metal surface to the required thickness without seams or laps. Units up to one foot long are rubber-covered inside and out, including flanges and bolt holes; while longer lengths are given an application of rubber paint on exterior surfaces.

G-E Unicord

Diving Gear of Rubberized Fabric

Also, the use of synthetic rubber in the cover is said to prevent weather cracking, a major source of loss since it permits rapid evaporation of gasoline and permits moisture to enter the cover. Hewitt Rubber Corp.

Three-Wire Unicord

A THREE-WIRE all-rubber Unicord for connecting electric stoves with supply lines comprises an attachment plug molded directly to the rubber cable. The new unit makes possible connecting electric ranges with terminal blocks, located near the floor, to outlets with a single smooth bend in the conductors. General Electric Co.

Self-Contained Diving Suit

A DIVING suit, designed for safe operation in deep water, is made of soft rubberized fabric with all-rubber elastic cuffs and waist band construction. Air is supplied by air bottles and purifying apparatus contained in a rubber-covered compartment carried on the back, thus eliminating outside air connections. A single rubber-covered cable comprising both telephone line and lifeline goes to the diver. The chromium plated helmet is cushioned with sponge rubber; while the nose and mouth piece are of rubber construction, as are the air tubes and air valves. N. L. Kuehn Co.

Improved Fire Hose

AS A result of efforts directed toward the obtaining of maximum strength with minimum weight in fire hose, an improved type has been developed which has a double-end yarn in the warp to give increased strength. Regulation of loom tension and balancing of yarn specifications and jacket design have contributed to the development. Also the hose is treated with new water-repellent materials which are said to be superior to wax treatments in that they do not harden in below-freezing weather. The B. F. Goodrich Co., Akron, O.

UNITED STATES

Defense Plans Accelerate Business Upswing

Despite conditions abroad upon which much depends, industry in this country continues to improve, with defense preparations acting as an important spur. Reports on employment, wages, and national income substantiate the betterment in business which became noticeable in heavy industrial lines toward the end of April; and the recovery movement last month spread out over a considerably broader base. Although the current level of production is still below the high peak of the last quarter of 1939, indications are that the advance of this summer will become more pronounced in the third quarter.

The holiday early in July cut production in most industries. Further declines continued in tin plate operations, but gains were recorded for steel (up to 90.4% the highest this year); while fluctuations occurred in carloadings, lumber, oil, and power output, and the cotton mill rate. A recent survey, based on the gains made by railroads so far this year, estimates their earnings for 1940 will make it their best year since 1930. Leather footwear, which has been quiet for several months, is now more active. Heavy electrical buying, at a high rate since May, threatens to score a record. Construction maintains its steady pace, in private contracts as well as commercial and industrial building. Interest in plant expansion is quite keen, with the volume of planned work the largest in years. Paper production also is running close to capacity. Manufacturers of automotive parts and accessories, however, reduced employment somewhat as demand from car makers slackened.

Automobile output declined contraseasonally last month. Sales, however, have been improving, also in a contraseasonal trend, reducing dealers' stocks and thus creating the basis for a fine start on 1941 models. Expectations are for a good third-quarter retail market and a favorable late-summer used car trade. Most plants shut down for model changeover the end of July, the earliest since automobile shows in the fall were originated, although some plants extended 1940 car runs a week or so to meet demand. Several plants will be making new models by mid-August, and most companies are expected to introduce them early in September. One report even promises displays of new models this month.

Rubber manufacturers report business is picking up and expect the fall to witness even greater improvement. Footwear, mechanicals, and insulated wire continue to advance; while replacement tire sales have increased, and original equipment sales have been good. The value of manufacturers' inventories of rubber products is steadily rising, as is the value of manufacturers' shipments.

EASTERN AND SOUTHERN

American Cyanamid Steps Up Acrylonitrile Production

Production of acrylonitrile, essential intermediate in the manufacture of the butadiene-acrylonitrile co-polymer types of synthetic rubber, is being doubled to meet increasing demand, according to an announcement on July 15 by B. W. Henderson, manager of the Rubber & Rubber Chemicals Division of the American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, N. Y. Commercial production of acrylonitrile was undertaken some months ago by Cyanamid to supply the demand from makers of synthetic rubber.

Aero Brand acrylonitrile is a colorless liquid with a mild odor, boiling at 77° C., and is stable on storage or shipment in steel drums. It has a high degree of purity, requisite in synthetic rubber production. A trace of copper or of certain amines inhibits the copolymerization of acrylonitrile with butadiene completely; while certain other impurities accelerate the reaction so much that it cannot be controlled.

The development of acrylonitrile by Cyanamid was an outgrowth of research work on calcium cyanamide, the primary product in its manufacture. Acrylonitrile is highly reactive chemically, and its present availability in large quantities is expected to lead to new uses in chemical synthesis as well as in the field of synthetic rubbers, resins, and plastics.

Standard Oil Development Co., 26 Broadway, New York, N .Y., has announced that President Frank A. Howard has been elected a vice president of the Standard Oil Co. of New Jersey, in charge of all chemical research, and patent matters.

Charles E. Stokes, president, Home Rubber Co., Trenton, N. J., and Mrs. Stokes are spending some time at Spring Lake, N. J.

CALENDAR

Sept. 12-13.	Rubber Division, A. C. S. Annual Meeting. Book-Cadillac Hotel, Detroit.
Oct. 7-11.	National Safety Council. 29th Annual Safety Congress and Exposition. Stevens Hotel, Chicago.
Oct. 8	Los Angeles Rubber Group, Mayfair Hotel.
Oct. 12-19.	National Automobile Show, Grand Central Palace, New York.
Dec. 2-7.	14th National Exposition of Power & Mechanical Engineering. Grand Central Palace, New York.

Tax on Tires and Tubes Raised

In the new tax bill designed to finance the national defense program, signed June 25 by President Roosevelt, increases were listed in the excise tax on commodities, effective July 1, including the following: tires, pound, from 2¼ to 2½¢; inner tubes, pound, from 4 to 4½¢; auto parts, accessories, sale price, from 2 to 2½%. The prices of tires and tubes have been increased commensurately, and in general this advance has amounted to less than 1%.

P. R. Jameson, vice president, Taylor Instrument Cos., Rochester, N. Y., recently predicted that his company, manufacturer of recording and gaging instruments to measure temperature, humidity, and the flow of gases and power sources, which are used in many industries, would, on the basis of the sharp gain in volume during the six months of 1940 partly due to national defense preparations, show a rise of from 20 to 30% for its sales in the fiscal year beginning July 1. In considering the possibility of priorities for the defense program, Mr. Jameson thinks there is not much chance that government purchases would cut into potential production for industrial and commercial sales. He further believes that despite higher costs for nearly all materials, prices for the immediate future would not be increased. Thus his company is relying upon a greater volume of sales to compensate for the rising costs of raw materials.

Continental Carbon Co., 295 Madison Ave., New York, N. Y., has appointed as development engineer, Bradway S. Phillips, who will engage in carbon black development problems at the Continental plant, Sunray, Texas. A graduate of Ohio State University as chemical engineer in 1929, Mr. Phillips was associated with The B. F. Goodrich Co., Akron, O., during the past decade. While there he was occupied with the testing of incoming materials and for a number of years was compounding chemist specializing in processing methods affecting mixing, calendering, and tubing. He was also with the tire development division as development compounder on tire treads.

Meeting of Rubber Research Committee

Recently the Rubber Research Committee of the Sub-Division on Rubber and Plastics of the American Society of Mechanical Engineers met at the Engineering Societies Bldg., New York, N. Y., under the leadership of Felix L. Yerzley, of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., chairman of the Sub-Division. J. F. Downie Smith, of the Edward G. Budd Mfg. Co., Philadelphia, Pa., presented a report, based on an extensive survey, which included many questions pertaining to rubber, the replies to which are wanted by mechanical engineers in the automotive, aircraft, railway, and other fields. The Committee then considered the best way to give to mechanical engineers data concerning the properties and characteristics of rubber.

The Rubber Research Committee, organized last year, is primarily interested in making available such information as will aid in the mechanical evaluation of rubber for design purposes.

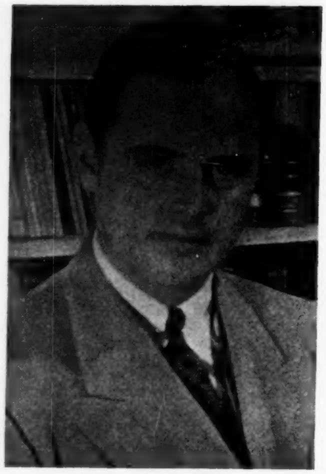
General Dyestuff Corp., 435 Hudson St., New York, N. Y., has started construction of a new building on Wilkinson Blvd., Charlotte, N. C., which will be 130 feet wide by 200 feet long and consist of basement, first and partial second floors, with provision for extending the second floor as the need arises. The basement and the first floor will be used for storage; while the second floor, featuring fluorescent tube lighting and air conditioning, will house the office and a laboratory. The building will be of concrete up to and including the first floor slab and from there on up, of structural steel with wood floors. The exterior will be of brick with limestone trim from the first floor up; while steel sash with ventilating units will be used throughout. Glass block panels in turn are included in the façade, and the building will be equipped throughout with sprinklers.

Pierce-Roberts Rubber Co., Trenton, N. J., finds business picking up and is now operating with two shifts with a number of orders on hand.

Benjamin M. Rosenthal, president, Nearpara Rubber Co., Trenton, N. J., vacationed in Canada.

Essex Rubber Co., Trenton, N. J., held its three-day semi-annual conference on July 15, 16 and 17, at Trenton, attended by 40 salesmen from all over the country. Luncheons and dinners were served and the visitors also enjoyed golf at the Trenton Country Club. J. R. Hewitt was in charge of the conference.

Foote Mineral Co., manufacturer of chemicals, metals, and mineral products, 4041 Ridge Ave., Philadelphia, Pa., last month announced that Wm. A. Maxwell has joined its research staff.



John S. Plumb

Buffalo Group Chairman

The name of Plumb has long been well known in the reclaimed rubber industry, and carrying on the tradition is John Scott Plumb, recently elected chairman of the newly created Buffalo Group of the Division of Rubber Chemistry of the American Chemical Society. He is also factory manager of the U. S. Rubber Reclaiming Co. plant in Buffalo, N. Y. He joined the company in 1928 as control chemist and two years later was made assistant technical superintendent. Then in 1933, Mr. Plumb became production manager and was assigned to his present duties four years ago.

Mr. Plumb was born in Buffalo on April 14, 1908. He attended Lawrenceville School and Princeton University, graduating in 1928 with a B.S. in chemical engineering.

He belongs to the Saturn Club of Buffalo and the Buffalo Tennis & Squash Club. His hobby is photography.

Married, he has two small daughters: one, age six; the other, two. His home is at 40 St. James Pl., Buffalo.

Thiokol Corp., Trenton, N. J., reports normal business. Dr. Joseph C. Patrick, vice president, recently returned from a business trip to Kansas City.

The Neville Co., manufacturer of coal-tar products, Pittsburgh, Pa., has appointed Paul V. McKinney as director of research, especially on the production of synthetic resins and organic chemicals. Dr. McKinney formerly was Senior Fellow in the work of the Texas Gulf Sulphur Co. at the Mellon Institute of Industrial Research. Prior to this recent work he was engaged in research on catalytic processes for the Phillips Petroleum Co. The eight years previous were spent in teaching college chemistry, and graduate study was in the field of adsorption and catalysis at Princeton University.

Stryker Joins SAE

Society of Automotive Engineers, Inc., 20 W. 39th St., New York, N. Y., through John A. C. Warner, secretary and general manager, has announced that Carleton E. Stryker, well-known Pacific Coast aircraft engineer, has joined the SAE headquarters staff to take charge of the Society's national defense responsibilities in establishment of standards pertaining to aircraft and aircraft-engine parts and materials. Although final plans have not been completed, rubber products will definitely be among the items with which Mr. Stryker and the committees will be concerned.

T. P. Wright, Curtiss-Wright vice president, now consultant to the aeronautical section of the Knudsen-headed division of the National Defense Advisory Commission, recently stated that the SAE would be expected to undertake consolidation of standards work pertaining to aircraft and aircraft-engine parts and materials because "it already possesses the system and the machinery for carrying out the job based on wide experience in carrying through a highly successful standardization program for many years."

Mr. Stryker has been in the aeronautical industry since 1917: was an instructor in the U. S. Navy Aviation Gas Engine School at Columbia University; helped establish the Great Lakes Aviation School and still holds a lieutenant's commission as aviation specialist in the Naval Reserve; designed power-plants for the Aircraft Engine Co.; was designer and engineer for the Airplane Development Corp.; was chief engineer of the Curtiss-Wright Technical Institute of Aeronautics at Glendale, Calif., and recently was with Bendix Aviation, Ltd. At one time he also was consultant for the aeronautics branch of the Department of Commerce.

Crescent Insulated Wire & Cable Co., Trenton, N. J., is experiencing a business boom and during the past few weeks has hired more than 250 extra employes. Vice President C. Edward Murray, Jr., announced that so many orders are on hand that the plant expects to operate to capacity for some time. During the early summer the company was compelled to lay off many workers when business suddenly took a slump.

The Rubber Manufacturers' Association of New Jersey, Mechanical Division, held its annual outing, including golf, at the Trenton Country Club, Trenton, N. J., July 9 and 10. Representatives of many rubber companies were present from various parts of the United States.

Whitehead Bros. Rubber Co., Trenton, N. J., has announced a better trend in business. Treasurer R. J. Goehrig was on a three-week business trip in the Midwest and the Northwest.

L. Albert, of L. Albert & Sons, dealer in rubber machinery, Trenton, N. J., visited the plant at Akron, O., on business.

Puritan Rubber Co., Trenton, N. J., finds demand better for rubber tiling and is operating normally.

Lee Rubber & Tire Corp., Conshohocken, Pa., according to President A. A. Garthwaite, has been operating all its plants at full capacity, and the incoming business in June was 25% over capacity.

Mercer Rubber Co., Hamilton Square, and **Pocono Co.,** and **Martindell Molding Co., Inc.,** both of Trenton, all in N. J., all have increased working hours.

United States Department of Labor, Washington, D. C., in its recent lists of government supply contracts awarded includes. CHEMICAL WARFARE: *gas mask carrier,* Goodyear Tire & Rubber Co., Akron, O., $88,167; COAST GUARD: *cable,* Okonite Co., Passaic, N. J., $10,137; MINT: *rolling mill unit,* Farrel-Birmingham Co., Inc., Ansonia, Conn., $23,396; NAVY: *cable,* Anaconda Wire & Cable Co., New York, N. Y., $82,703, Bishop Wire & Cable Corp., New York, $15,391, General Electric Co., Schenectady, N. Y., $130,316, Okonite, $117,353.80, Phelps Dodge Copper Products Corp., Habirshaw Cable & Wire Division, $117,764, Rockbestos Products Corp., New Haven, Conn., $118,203; *packings,* Garlock Packing Co., Palmyra, N. Y., $10,936; *sodium nitrate,* Barrett Co., New York, $29,400; *tape,* E. I. du Pont de Nemours & Co., Inc., Newburgh, N. Y., $17,515; PANAMA CANAL: *cable,* John A. Roeblings Sons Co., Trenton, N. J., $17,250; WAR: *outlet valves,* Martin Rubber Co., Inc., Long Branch, N. J., $19,917; *raincoats,* Sigmund Eisner Co., Red Bank, N. J., $112,000, Globe Sales & Mfg. Co., New York, $30,000; *tank band tracks,* B. F. Goodrich Co., Akron, $1,409,439.

OHIO

Taylorcraft Aviation Corp., Alliance, O., recently completed the largest fly-away delivery of non-military planes in the history of aviation when, on July 1, twenty light trainers and de luxe models, flown by twenty sportsmen-pilots, took off and completed the leisurely 2,500-mile trip on July 5 at Los Angeles, Calif. On arrival the planes were distributed for use in the CAA Training Courses of University of Southern California, University of California in Los Angeles, Loyola University, San Bernardino Junior College, Santa Ana Junior College, Pomona College, and the Pacific Aeronautical College. All the ships are equipped with tires, wheels, and brakes made by the Firestone Tire & Rubber Co., Akron.

J. Edward Trainer

Firestone Tire & Rubber Co., Akron, at a meeting of the board on May 31 elected J. Edward Trainer a vice president. He will also continue as general production manager of all Firestone plants, which position he has held since he joined the company on January 3, 1939. During the World War Mr. Trainer served in the chemical warfare division of the United States Army following his graduation from Pratt Institute of Science & Technology at Brooklyn, N. Y. Besides he has been very active for many years in Akron civic affairs.

Litchfield on the Rubber Situation

In discussing the rubber situation recently Paul W. Litchfield, president of The Goodyear Tire & Rubber Co., Akron, outlined the following four-point program for assuring the United States of adequate supplies of rubber:

1. That the government take steps to provide immediately a nationalized emergency reserve of crude rubber up to 400,000 tons in excess of current commercial needs;
2. That the government take the lead in a program of conservation including the collection of larger supplies of scrap rubber for reclaim and the placing of an embargo on exports of crude rubber or scrap;
3. That encouragement be afforded moderate expansion of our facilities for the production of synthetic rubbers;
4. That the government appropriate for and encourage the development of rubber plantations in tropical Central and South America.

Mr. Litchfield estimated that approximately 575,000 tons of crude rubber will be utilized by the American industry in 1940 and in addition that 190,000 tons of rubber are being reclaimed from our scrap piles. With increased effort toward scrap collection and an embargo on exports, he believed that the supply could be doubled easily and that processing plant capacity would be expanded to between 500,000 and 600,000 tons in approximately one year. He estimated that this expansion would cost in the neighborhood of $25,000,000 and that the scrap reserve would accommodate such a production for about two years. Regarding synthetic rubber, Mr. Litchfield said that estimates indicate that a production capacity up to 100,000 tons might be possible within one year, but would require an investment between $25,000,000 and $50,000,000. Pointing out that the protracted interruption of supplies would be illogical even though control of present rubber growing areas were to change, he stressed the possible hazard and the need of precautionary measures.

Goodrich Executive Changes

George W. Vaught, formerly treasurer and a director of Montgomery Ward & Co., on June 27 was elected a vice president and treasurer, effective July 1, of The B. F. Goodrich Co., Akron. V. I. Montenyohl, Goodrich treasurer since 1926, was elected a vice president.

Harold Duryea, since 1935 sales supervisor for Goodrich, has been named New York district manager, succeeding Joseph E. Powers, recently transferred to Akron as sales manager of the truck and bus tire department.

World's Fair Center to Stay

Robert Moses, Park Commissioner of the City of New York, last month in announcing the units of the World's Fair that will remain as parts of the Flushing Meadow Park, to take the place of the Fair when it closes October 27, included the Goodrich building and its Daredevil Drivers Arena. No mention was made of how the building would be utilized, but the arena, which has a seating capacity of 5,000, is scheduled for a bicycle track.

Koroseal Resists Mustard and Hydrogen Gases

In a talk at the recent annual show of the New York Housewares Manufacturers Association in Atlantic City, N. J., Dr. Howard E. Fritz, manager of the Goodrich synthetics division, stated, "In tests against mustard gas penetration, koroseal has been found superior to the best rubber compounds; while fabrics treated with this substance have been proven many times more resistant to hydrogen gas diffusion than rubber coated fabrics."

The Philadelphia Rubber Works Co., Akron, recently appointed Allyn I. Brandt as general sales manager. Mr. Brandt, who entered the rubber industry after his graduation from Case School of Applied Science twenty years ago, has a broad technical background in this field and for the past decade has also been very active in the field of reclaimed rubber. He is now serving his second term as president of the Rubber Reclaimers Association, Inc.

Goodyear Expanding

The Goodyear Tire & Rubber Co., Akron, has announced expansion of its production facilities at its Gadsden, Ala., plant. The contract for the construction of a $175,000 addition at Gadsden has been awarded to The A. K. Adams Co., Atlanta, Ga. A. C. Michaels, Goodyear superintendent, stated construction work would begin immediately and be rushed to completion in anticipation of the need of additional manufacturing and warehouse space. The new building will be one-story, 100 by 560 feet, of brick, concrete, and steel. Mr. Michaels said the company is not yet ready to announce what type of manufacturing equipment will be installed in the new addition.

Goodyear also has headquarters in the R C A Bldg., Room No. 4633, Rockefeller Plaza, New York, N. Y., which is used by dealers and customers in the city during the summer attending the World's Fair. In addition airship flights for dealers and customers are handled at this address.

Annual Picnic

The gala and well-attended Annual Goodyear Frolic, under the guidance of Fred Colley, head of Employes Activities, was held at Euclid Beach Park on July 29. Liberal prizes, including two round-trip tickets and two admissions to the World's Fair in New York, were awarded the winners of various races, games, and other contests.

Farm Essay Contest

Goodyear recently announced the grand and cash prize winners of its national essay contest conducted for high school farm boys on the topic "How Rubber Tires Have Changed Farm Equipment and Methods." Grand prize, an all-expense paid vacation trip to Timagami Lake, Ont., Canada, as guest of Paul W. Litchfield, Goodyear president, went to ten boys, and awards of $25 each were given 25 others.

New Goodyear Tires

Three truck tires, a large earth mover tire, and a new line of bicycle tires were recently announced by Goodyear. Two Hi-Miler truck tires, one with a rib design and the other with an All-Weather tread, are designed for use on trucks and buses in service where uniform wear and long mileage are major considerations. Both tires are said to have tough, deep treads, and to employ low-stretch Supertwist cords. A new YKL truck tire replaces the former tread design with an all-rib style, but retains the same shoulder and body appearance. The tread design has the same outward appearance as that of the Hi-Miler rib tire. The body of the YKL continues to be constructed of rayotwist cord.

In the off-the-road tire field, a new 21.00-24 Sure Grip tire for use on giant earth mover machines has larger load-carrying capacities than earlier types. The new tire is made in 20-ply construction for a 15-inch width rim. It has an overall diameter of 70.5 inches, and at 10 miles per hour travel the maximum load per tire is 17,330 pounds.

Goodyear's line of bicycle tires and tubes with recent additions is now said to provide a type for every rider's need and pocketbook. The line includes: new Double Eagle with rayon cord replacing cotton cord in the carcass; new De Luxe All-Weather with carcass of Supertwist cord; G-3 All-Weather made with Supertwist; and new Speedway and new Rib-Type for light-weight bicycles. The line also includes a new puncture-resistant tube, made with heavier tread section.

Personnel Notices

On July 15, Paul W. Litchfield, Goodyear president, celebrated his fortieth anniversary with the company.

J. L. Sturges, mechanical goods salesman for Goodyear at Jacksonville, Fla., recently was named southern district manager of mechanical goods sales with headquarters at the Atlanta, Ga., office. He succeeds E. A. Filley, who resigned to become general manager of The Manufacturers Rubber Supply Co., Goodyear mechanical rubber goods distributer for the Akron area.

Gordon C. Mack, of the Goodyear Patent Department, is continuing the patent law practice of the late Robert M. Pierson in the Akron Savings & Loan Bldg., Akron, O.

Interstate Welding Co., in order to meet the growing demand for its Banbury rebuilding service, has been compelled to move to new and larger factory quarters at 914 Miami St., Akron.

National Battery Manufacturers Association, 2706 First Central Tower, Akron, O., according to its commissioner, V. L. Smithers, held its spring meeting May 16 and 17 at White Sulphur Springs, W. Va., at which the name of the organization was changed to The Association of American Battery Manufacturers, Inc.

MIDWEST

Auburn Wins Grand Award in Toy Packaging Contest

The 1940 Grand Prize Trophy, awarded by the judges of the Third National Toy Package Competition, sponsored by *Toys and Bicycles,* went to the Auburn Rubber Corp., Auburn, Ind., for its attractive new package of molded rubber toys. In developing the new package, Auburn had the services of Martin Ullman, well-known package design counselor.

The new package features attractive display qualities, good color combinations, and easy determination of box contents on the outside wrapper. The box is one-piece, narrower, but higher than ordinary boxes in which small toys are packed. A chipboard slip-cover, when removed, permits the front side of the box to tilt out, projecting a number of toys forward and forming a display platform with the bottom of the box. Grooves into which the base of the toys are slipped hold the pieces vertically in the proper display arrangement. The redesigned Auburn package has not added to the retail price, it is claimed, and has resulted in increased sales volumes for these toys.

Auburn's Prize-Winning Package

The National Chemical Exposition, sponsored by the Chicago Section, American Chemical Society, is scheduled for December 11 to 15 at the Stevens Hotel, Chicago, Ill. Manager of the exposition is M. W. Hinson, 110 N. Franklin St., Chicago.

O. D. Bullerdick, for some time sales manager in Indiana and Ohio for the Gillette Rubber Co., Eau Claire, Wis., is also president of the Wholesale Tire & Rubber Co., 821 N. Illinois St., Indianapolis, Ind., recently organized to handle a complete line of Gillette tires.

NEW ENGLAND

Hanslick to Retire

V. J. Hanslick, who retired August 1 after 34 years as a chemist with the United States Rubber Co., was honored at a dinner by 60 fellow-workers at the Providence, R. I., plant on July 15, when he was given a gold watch and chain. Born and educated in Czechoslovakia, he taught organic chemistry in Prague many years before coming to the United States. In 1906 he became chief chemist of the Revere Rubber Co., Chelsea, Mass., and continued as such after the firm's absorption by

U. S. Rubber. When the Chelsea plant was abandoned in 1930, Mr. Hanslick went to the development department at Providence. He made many contributions to the rubber industry. He was one of the first to recognize the use of organic materials as vulcanization accelerators. Before aniline was generally adopted by the rubber industry he had already used it in an attempt to reclaim scrap rubber and had found that it accelerated the cure. Shortly after the World War he made the first application of rubber in this country to prevent corrosion of ship propeller shafts, a procedure that has since become standard practice. During his early years with Revere he also did pioneer work on soles, heels, steam hose, rolls, tanks, rubber tile, and belting; with U. S. Rubber he was instrumental in the development of "Uskide," the pioneer high carbon black sole stock.

The Naugatuck Chemical Factory Golf Team on June 27 met the team from the New York office of Naugatuck Chemical Division of United States Rubber Co., Rockefeller Center, at Hop Brook Club, Naugatuck, Conn., in the first of the annual golf matches to be played for the General Manager's Trophy. A cup was given by the Alembic Association of Naugatuck Chemical, and the factory team won its custody for the first year by defeating the New York office 38½ to 12½.

Firestone Rubber & Latex Products Co., Fall River, Mass., effective July 1, announced a price differential between its single and full-size Airtex mattresses. The company further reported that consumer acceptance of latex mattresses has been more rapid than was the case with the innerspring mattress when it was first marketed several years ago.

C. J. Leonard, 91 Nashua St., Fitchburg, Mass., has a complete file of India Rubber World beginning with September, 1932, and ending with December, 1939, which he is offering for sale as a complete set or as individual copies. Those interested please communicate with Mr. Leonard direct.

PACIFIC COAST

New Plastics Institute

The Plastics Industries Technical Institute, 186 S. Alvarado St., Los Angeles, Calif., will begin its first course of technical training on September 16, teaching all phases of plastics manufacture including application, fabrication, design, research, and sales. John Delmonte, former intructor in Plastics at Armour Institute, and author of "Plastics in Engineering," is technical director and will supervise instruction. Frederic Selje, formerly in charge of the Design Division of Chrysler Corp., is director of Art and Design. Dr. Paul Ivey, professor in Sales Research and Merchandising at the University of Southern California, will be director of Sales Research and Merchandising. The board of directors follows: Francis Gudger, former manager of what is now the Arlington Division of E. I. du Pont de Nemours & Co., Inc.; Ralph Hemphill, chairman of the board of Aero Industries Technical Institute and of Plxweve Aircraft Corp.; and Horace Blackman, Sr., former general sales manager of the Parker Pen Co.

The Institute last month announced the appointment of E. F. Lougee as chairman of the board of governors. Mr. Lougee, formerly editor of *Modern Plastics* magazine, is now in Los Angeles working with Mr. Delmonte, completing details of the curriculum and training to be made available. The initial educational program embraces a thorough study of all plastic materials; their history and background; methods of classification; their relations to various engineering and industrial fields; their nature and properties; and forms in which they are available for manufacturing purposes. This general program will be followed by specialized training in mold design and molding; methods of laminating and types of materials used; methods of casting plastics and their utility; fabrication; styling and design; finishing materials; extent of applications including study of market possibilities; and methods of testing plastic materials.

Students may elect courses in specialized training to suit individual requirements. Full-time courses at Plastics I. T. I. will be based upon actual projects which students develop from blue-prints to finished products. Courses for home training will be available and may be supplemented by intensified shop practice at the Institute upon passing satisfactory entrance examinations.

CANADA

Seiberling Executive

Born in Bremen, Ga., on February 18, 1892, Marcus L. Brown, Jr., is vice president in charge of production at the Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont. He attended elementary school, Donald Fraser High School, and Georgia School of Technology (B.S. in mechanical engineering, 1914).

From July, 1914, to December, 1916, he did time study and other work in the open hearth division at the Atlantic Steel Co. The next five years were spent in the development department of the Goodyear Tire & Rubber Co., Akron, O., except for the period March, 1918, to April, 1919, when he was in the army. In December, 1921, Mr. Brown was hired by the Seiberling Rubber Co., Akron, where he served in various capacities. In November, 1928, he was made a director and factory manager of the Canadian organization, positions he still retains. He was appointed to his present post in January, 1940.

Marcus L. Brown, Jr.

Mr. Brown is a Mason, Knight Templar, and member of the Society of Automotive Engineers and last year was chairman of the latter's Canadian Section. His hobbies are golf, bridge, and reading.

He is the father of two daughters. The Brown residence is at 57 Wendover Rd., Kingsway Park, Toronto.

Taxes on Tires and Tubes Up

Increased taxation on automobile tires and inner tubes, announced in the Dominion Budget by Hon. J. L. Ralston, Minister of Finance, will, in the opinion of manufacturers, result in an increase of 63¢ per tire and 6¢ on tubes in the most popular size, 600-16. On the 525-550-17 size of passenger-car tire, next in popularity, there will be a 60¢ increase with the advance in tube prices the same as in the larger size, 6¢. The tax on tires and tubes has been advanced from 2¢ and 3¢ respectively to a flat 5¢ per pound and is expected to result in revenue of $1,100,000 in a full year and $825,000 in the current year.

The tax does not apply when the goods are used exclusively for the original equipment of automotive vehicles.

No change is made in the tariff on woven-cord tire fabric which enters free under the British preference and is taxed 15% under the intermediate and 25% under the general tariff.

Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont., through President A. G. Partridge in a letter to shareholders enclosing quarterly dividend checks, stated: "While complete reports for the first six months

are not yet available, our total sales for this period will compare very favorably with the same period of 1939, and earnings will continue to exceed dividend requirements. In Canada new car and truck registrations are over 30% ahead of 1939."

The Canadian Department of Munitions and Supply included the following among its recent contracts awarded: Sieberling Rubber Co. of Canada, Ltd., Toronto, Ont., $15,050; Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., $18,318; Boston Insulated Wire & Cable Co., Ltd., Hamilton, $8,704; Dominion Rubber Co. Ltd., Montreal, P. Q., $90,780; B. F. Goodrich Co. of Canada, Ltd., Kitchener, Ont., $68,850; Gutta Percha & Rubber Co., Ltd., Toronto, $36,020.

The Dominion Bureau of Statistics reported that during May, Canada imported 6,699,666 pounds of raw rubber, value $1,377,082, against 6,733,998 pounds, value $1,025,335 in May, 1939. The Straits Settlements contributed 5,370,856 pounds, Ceylon 489,220 pounds, United Kingdom 447,934 pounds, United States 389,355 pounds, and Netherland India 2,301 pounds. Canada's exports of rubber products during May were valued at $943,000, against $1,403,000 in May, 1939. The decrease is attributed to the war.

Rubber Association of Canada recently elected a new president, George W. Sawin, vice president and general manager of The B. F. Goodrich Co. of Canada, Ltd., Kitchener, Ont.

FROM OUR COLUMNS

50 Years Ago — August, 1890

It is evident that the business of rubber gathering is not keeping pace with the progress of the world's manufacturing industries. Next must follow soon the culture of rubber. (p. 241)

The Boston Belting Co. are meeting with much success in supplying rubber covered rolls for paper-mill work; they are now being used in almost all the larger mills in this country, and in many in Europe. (p. 248)

We consume in this country two-thirds of all the rubber produced in the world, and there is not today more than enough surplus rubber in the United States to supply the manufacturers of rubber goods for three weeks. This industry represents a product of $50,000,000 per annum, employs more than 20,000 workmen, and has doubled within the past 15 years in this country. (p. 252)

It might prove to be possible by cross fertilization to evolve a rubber tree from the *Hevea Brasiliensis* which would admit of being cultivated in the vast expanses of waste land in Florida, Louisiana, and at other places around the Gulf of Mexico and the Carolina sounds. (p. 257)

25 Years Ago—August, 1915

Mr. Orville Wright states that for proper protection in times of peace, not to mention requirements in times of war, our military equipment should include at least 2,000 aeroplanes, which would be very nearly 2,000 more than we have at present. (p. 583)

The workers in American rubber mills get about three and a half times the wages paid for the same class of work in Germany. (p. 584).

Without rubber the submarine would be so full of leaks that it would go to the bottom like a stone, and without rubber the aviator, though he might succeed in getting up, would certainly be afraid of coming down. (p. 585)

Machine for Testing Hardness.—This invention is a device by which the hardness of material is measured by the penetration of a hard ball under an adjustable load and the result indicated on a vernier. (Tinius Olsen, U. S. patent No. 1,141,881). (p. 601)

A simple apparatus has been designed by M. M. Kahn, of the New York Insulated Wire Co., especially to take care of the so-called "permanent set" test, introduced by the Underwriters' Laboratories for testing rubber insulation. (p. 602)

Rubber foam was first patented in Germany, on August 10, 1910, by Fritz Pfleumer, an Austrian engineer. A United States patent (No. 1,038,950) was granted to Mr. Pfleumer for his invention on September 17, 1912. (p. 610)

OBITUARY

Wm. B. Pratt

WILLIAM BEACH PRATT, noted authority on rubber and textiles, died at his home in Boston, Mass., on July 13. He was born in Elmira, N. Y., 68 years ago. After graduating from Amherst College in 1895, he went to the University of Pennsylvania as a medical student, but in later years won fame as a chemical engineer. Until 1907 and during the World War he made important contributions in the development of explosives. Then two decades were devoted to rubber research, field work in Central America for new sources of supply of crude rubber, work with reclaimed rubber, and the development of artificial latex. His later years were spent in textile research.

Mr. Pratt held many patents on his processes both here and abroad. Thus in 1923 he invented the process for water dispersion of rubber, first patented in Italy, then in the United States and many other countries. Again in 1929 he was granted a patent covering a method of dispersion of crude and reclaimed rubber. The deceased maintained a laboratory known as W. B. Pratt, Inc., devoted to aqueous dispersions of rubber, rubber compounds and substitutes, gums, waxes, etc., which was acquired early in 1926, along with the Aqua Rubber Co., which specialized in the production of dispersed rubber compounds under the Pratt patents, by Research, Inc., Boston, for whom Mr. Pratt and his associates continued their laboratory activities. Research, Inc., and its subsidiaries, in 1928 were taken over by Dispersions Process, Inc., since 1929 controlled by the United States Rubber Co., New York, N. Y.

Mr. Pratt is survived by his wife, a son, and two daughters.

Funeral services were conducted on July 15 at the Wellesley Hills Congregational Church. Interment was in Wildwood Cemetery, Amherst, Mass.

James A. Barrett

AFTER a two-month illness James A. Barrett, 69, director of planning and engineering of the United States Rubber Co., with which he had been associated nine years, died in Philadelphia, Pa., June 26. Prior to joining U. S. Rubber he had been for 37 years an operating executive of the Baldwin Locomotive Co.

Wm. P. Earle, Jr.

AN ABDOMINAL ailment caused the death, on July 7, of William Pitman Earle, Jr., partner in Earle Bros., 38 Pearl St., New York, N. Y., dealer in balata, gums, gutta, chicle, and other Central and South American produce. Born in Brooklyn, N. Y., 57 years ago, Mr. Earle was educated at Polytechnic Preparatory School, Pratt Institute, and Ohio State University (Class of 1908).

He was very active in philanthropic, civic, and church affairs in Brooklyn. He was president of the Brooklyn Park & Playground and the Brooklyn Heights Civic Associations, a pioneer member of the Brooklyn Big Brother movement, for many years treasurer of the Republican Club of the First Assembly District, a deacon and a trustee of the Plymouth Church of the Pilgrims, a director of the Central Branch Y. M. C. A., and a member of Delta Tau Delta, and the Anglers and the Rembrandt clubs.

Survivors include his wife, a daughter, a brother, and two sisters.

The funeral was held at the Plymouth Church on July 9. Burial was private.

(*Continued on page* 88)

EUROPE

GREAT BRITAIN

New Rubber Flooring

Under the name Terrubo, George MacLellan & Co., Ltd., Maryhill, Glasgow, is marketing a new rubber flooring, final patent for which recently was obtained. It is claimed for Terrubo that it provides the architects and interior decorators with an entirely new medium for the original expression of design and color in floor coverings. The material shows a granite effect in which the contrasting colors are regular in size and evenly dispersed, thus eliminating the difficulty of the occasional blobs of color which occur in marbled patterns. Unlike compounds in which a granite pattern is produced by filling a rubber base with ground cork, marble chippings, etc., Terrubo patent flooring is all rubber. The flooring is obtainable in rolls 36 inches wide and in thicknesses from 3/16-inch up. It is also supplied in cut tiles to order.

A new branch of the National Bank of Scotland at Partick has a floor of Terrubo in which the bank insignia, showing St. Andrew with his cross and the Scottish lion rampant, is carried out in nine colors of rubber.

Rubber Imports and Exports

During the first four months of 1940 crude rubber arriving in the United Kingdom represented a total value of £4,970,000, or almost double the amount in the same period of 1939. The April, 1940, imports came to £1,717,734, against £1,617,880 in March and £555,145 in April, 1939.

Reexports of crude rubber fell from £1,252,000 in the January-April, 1939, period to £879,000 in the corresponding period this year.

Exports of rubber manufactures continue to show substantial increases, which, however, are largely due to higher prices and freight rates. For the first four months of 1940, shipments of rubber goods represented a value of £952,639, against £489,346 in last year's period.

New I. R. I. Council Members

At the annual meeting of the Institution of the Rubber Industry on May 22, in London, the following were elected to the council: C. J. Beaver, T. A. Beazley, H. Berry, C. H. Birkitt, J. C. Burton, J. D Campbell, J. M. Chrystal, E. J. Coles, C. B. Copeman, W. E. Duck, R. N. Ferguson, H. Foulds, W. C. Gibbs, W. A. Hazlett, A. Healey, T. H. Hewlett, F. B. Jones, L. V. Kenward, G. Lever, R. Moseley, W. H. Nuttall, F. M. Panzetta, A. E. Penfold, G. H. Redman, L. R. Ridgway, A. Ryan, O. F. Swanborough, G. S. Whitby, J. Wilson, and P. Worth.

Notes

The Poppe Rubber & Tire Co, Twickenham, Middlesex, for purely family reasons has converted its business into a private limited company bearing the name Poppe Rubber & Tyre Co., Ltd. The managing directors are F. and S. F. Poppe, and the following are directors: R. F. Holden, R. W. Hamlyn, A. H. Manning, P. Bell. The conversion of the business into a private limited company will not affect the general conduct of the business which will be carried on in the same way as before.

Leyland & Birmingham Pension Trustees, Ltd., has just been formed with a nominal capital of £100 to undertake the office of trustee for the Leyland & Birmingham Rubber Co., Ltd., Staff Superannuation Scheme for the provision of pensions and other benefits for certain employes of the firm.

Kronos titanium pigments have hitherto been made by the British Titan Products Co., Ltd., from Norwegian ilmenite, supplies of which have been cut off by the German invasion of Norway. But the firm has large stocks of ilmenite at the factory, and ample supplies are available from other sources, chiefly India.

The North British Rubber Co., reports profits of £97,565 for 1939, against £39,046 in the previous year. The 5% dividend on first preference share for 1939 had been paid since the close of the financial year, and also two years' arrears of dividends on second preference shares, to December 31, 1937. The directors recommend payment of the remaining two years' dividend on second preference shares to December 31, 1939, and 5% dividend on the ordinary shares for 1939.

George Spencer Moulton & Co., Ltd., Bradford-on-Avon, reports profits of £32,671 (before paying debenture interest and taxation) for 1939, against profits of £62,562 in 1938, on the same basis. The profits or losses of subsidiaries abroad have been taken into account in the above figure. One of the subsidiaries, Pundut Estates, Ltd., has undertaken a replanting program, and the entire cost for this as well as for upkeep of the areas already planted is being paid out of revenue, which policy naturally has an adverse effect on the trading results of this enterprise until the new trees are tapped.

The "Old Mill," the building in which Charles Macintosh first began to manufacture waterproof garments and which was over 200 years old, recently was completely gutted in a fire at the Cambridge St. works (Manchester) of the Charles Macintosh company.

GERMANY

New Standards for Rubber Goods

The German Bureau of Standards has created a branch for rubber and rubber-like synthetics to be under the direction of Mr. Assbroicher, a member of the board of the Continental Gummi-Werke A.G. Two working committees have been formed, one for tires, under the management of Dr. Weber, and one for all other rubber goods, under Dr. Pahl. The work of the new bureau includes the setting up of quality standards for yarns, threads, and fabrics of natural and artificial fibers, metals, alloys, and other materials for the rubber industry. It also includes the standardization of forms and other manufacturing supplies in so far as this is possible. There are plans to establish size standards and other technical specifications for products of natural and synthetic rubber and other rubber-like materials, and in the first place for tires and tire accessories, soft rubber mechanical and surgical goods, cushions, dipped articles, and goods of hard rubber, gutta percha, and balata. The branch bureau will also take care of German interests in connection with international standardization work.

Printing Rubber Surfaces

In the usual method of printing rubber surfaces by means of engraved rolls, the latter are covered with color, which is then removed from the raised parts by means of a doctor so as to leave the color only in the depressions forming the design it is desired to transfer. At the Harburger Gummiwaren-Fabrik Phoenix A.G.[1] a simpler method has been devised. Pasty color, instead of being applied to the engraved roll, is spread on the side of the sheet of rubber that does not come in contact with the roll. Then as the rubber sheet passes over the roll under tension, the doctor wipes the color from the portions of the sheet directly over the raised parts of the roll, leaving the color only over the depressions. The chief advantage of this method is that the roll does not come in direct contact with the color and

[1] D. R. patent No. 691,013.

therefore does not have to be cleaned each time after use or when a different tint is employed. In addition there is no waste as every bit of the color can be utilized.

Company News

The Semperit Oesterreichisch-Amerikanische Gummiwerke A.G., Vienna, recently put on the market rubber printing blocks to take the place of the usual metal blocks.

The Harburger Gummiwaren-Fabrik Phoenix A.G., Hamburg-Harburg, last year raised its capital to 4,860,000 marks by issuing additional shares for 1,620,000 marks. Despite war conditions, business in 1939 was satisfactory, and profits amounted to 505,336 marks. This added to the carry-forward from 1938 of 285,140 marks brought the total to 790,476 marks.

NETHERLANDS

According to the latest figures available, imports of crude rubber by the Netherlands came to 4,350 tons in the first nine months of 1939, against 4,011 tons in the corresponding period of 1938. At the same time, 1,042 tons of scrap were imported (mostly from Great Britain), against 1,108 tons, and 120 tons of reclaim, against 58 tons. Imports of rubber manufactures totaled 1,800 tons, including 437 tons of driving belts, more than half of which came from Great Britain. But of the remaining 1,363 tons of other rubber manufactures, Germany supplied 554 tons, against 274 tons from Great Britain, 183 tons from the United States, 130 tons from Italy, and 63 tons from Japan.

SWEDEN

In 1938, Sweden was reported to have had 20 rubber goods factories of varying sizes, which together consumed 8,300 tons of raw rubber and employed about 6,500 persons. While the consumption of rubber represents an increase as compared with previous years, the total value of the goods produced declined from that of 1937. The chief products were: rubber footwear of all kinds, 4,300,000 pairs, value 18,300,000 kroner, against 4,600,000 pairs, value 19,600,000 kroner; other shoes with rubber soles, 2,560,000 against 3,050,000 pairs, value, 5,750,000 against 8,520,000 kroner; heels and soles, value 2,490,000 against 2,750,000 kroner; tires and tubes for motor vehicles, 2,127 tons, value 8,680,000 kroner, against 1,609 tons, value 10,570,000 kroner; cycle tires and tubes, value 4,010,000 against 4,530,000 kroner; belting, value 870,000 against 1,220,000 kroner; rubber balls, 104 against 66 tons; rubber raincoats, 100 against 95 tons; mechanical and other rubber goods, 2,190 tons, value 7,770,000 kroner, against 2,243 tons, value 7,960,000 kroner; rubber solution, 348 against 354 tons; elastic bands, 192 against 203 tons.

FINLAND

Finland is recovering from the effects of the war with Russia, and the country's rubber industry is again returning to normal, the *Rubber Age (London)* learns. For all practical purposes rubber production in Finland, which is not on a large scale, may be said to be controlled by one firm, the Suomen Gummitehdas O.Y., which owns the large Nokia plant near Tammersfors and a special factory for mechanical rubber goods at Savio, near Helsinki. The concern also had a third plant for making rubber flooring and rubber heels at Nurmi, near Viipuri, but this factory, in territory ceded to Russia, has been lost.

The Nokia plant, which employs about 1,800 workers, was started in 1898, devoted mainly to manufacturing rubber footwear, still the company's chief product, but since 1905 various other lines have been introduced, including belting, tubing, and, more recently, automobile and cycle tires. The firm is a pioneer in the manufacture of rubber matting and flooring, which are of a very high standard, it seems, and have become unusually popular in Finland. Indeed it is claimed that in probably no other country are these goods in such general use as here.

Before the war, exports of Nokia products were finding their way to various European countries and even penetrated as far as the Levant.

FAR EAST

MALAYA

An interesting discussion as to whether it is more profitable for producers to sell rubber in the form of liquid latex or smoked sheet was started in "The Straits Budget" recently when a reader proposed to prove that "the sale of latex from the estate owners' or shareholders' point of view is a bad thing." He pointed out that when smoked sheet is made, every 100 pounds contains 0.5% moisture plus about 1% smoke products. Consequently an estate gains in two directions by producing smoked sheet: gross receipts are 1½% higher than when latex is sold, and yield assessments are also higher by the same percentage. He also claims that sellers' weight figures are not accepted and quotes an actual case in which an estate made 11 shipments of latex in six weeks, invoiced at a total of 68,889 pounds, but was paid for only 63,915 pounds, a loss of 4,574 pounds. The buyer's weights for each shipment were less than those invoiced, the differences varying from 200 to 600 pounds.

These views were submitted by the Planting Correspondent of the above paper to an agency house, the general manager of a large group of estates and to W. S. Davey, head of the Chemical Division of the Rubber Research Institute of Malaya, for comment.

While all three were more or less in favor of latex sales, the agency house made it clear that though sales of latex were considered profitable in some cases, yet unless terms were exceptionally good, sales of sheet offered many advantages that would not be outweighed in the ordinary well-equipped estate. None of those approached seriously disputed that moisture and smoke products added weight in the case of sheet, but they pointed to opposing factors as inclusion of ammonia in latex, the addition of extra weight by managers shipping sheet to allow for evaporation of moisture, etc.

With regard to weight differences, the opinion was unanimous that these could easily be avoided by the proper use of an approved method of determining the dry rubber content of latex. The agency house and Mr. Davey also advised that the difficulty should be provided against by suitable clauses in the sales contract. Mr. Davey added that the Institute is always willing to assist in instructing estates in the method of calculating D.R.C. of latex and that the Institute is usually named as arbitrator in contracts.

In conclusion he pointed to a wider aspect of the question under discussion.

"Latex is opening up new uses for itself to a much greater extent than it is replacing old uses of sheet rubber," he said, "and an increasing output of latex means an increasing consumption of rubber. We should therefore not do anything to discourage the production of a new raw material and . . . the Institute will do all it can to see that the producer gets what he is entitled to.

"It is, I think, clear that no case has been made out for discouraging those who are either already disposing of their crop in the form of liquid latex or who may have intentions of doing so.

"On the other hand, it would, I think, be to the advantage of the industry if, as the market for liquid latex enlarges, more estates could be persuaded to do so, for I think there is little doubt that it will be in the form of liquid latex, more than in any other way, that extended uses for rubber are likely to be found."

CEYLON

War-Time Coagulant

During the period of severe shortage of rubber coagulants in Ceylon, which started soon after the outbreak of the war, but has since been relieved by arrivals of imports of acetic and formic acids, a large number of proprietary substitutes appeared on the local market. The Rubber Research Scheme immediately warned producers against using substitutes of unknown composition without having them tested. Despite this warning, M. W. Philpott, of the Ceylon Rubber Research Scheme, reports,[1] a number of these materials were used extensively and without discrimination, particularly by the smaller producers, who were hardest hit by the shortage.

Most of the substitutes tested at the Research Scheme contained sulphuric acid as their main ingredient with the addition, in many cases, of a small amount of acetic acid, sodium bisulphite, common salt, vinegar or fruit juices to give a pungent odor more or less reminiscent of the smell of formic and acetic acids. Several of the preparations were found to consist chiefly of alum, which has a harmful action on rubber, but appeals to users because it is cheap and produces a satisfactory type of coagulation. A few vegetable products, chiefly vinegar or vinegar with some sulphuric acid, were also offered. On the whole, the samples showed few traces of copper or manganese, although in one case the main constituent was copper sulphate. This preparation was, of course, promptly suppressed.

All substitutes for acetic or formic acids are more or less objectionable, says Mr. Philpott for two important reasons. First the acids named are the only known substances which not only convert latex into a workable coagulum, but at the same time are of a high standard of purity and uniformity, are normally available in adequate quantities at a reasonable cost, and do not adversely affect the quality of the rubber when not very carefully handled. To obtain standard rubber with sulphuric acid, for instance, very careful control is essential. Second, the rubber market views any change from normal methods of manufacture with extreme suspicion. Consequently the extensive use in Ceylon of any substitute, however harmless, would involve the risk of creating an undesirable market prejudice against Ceylon rubber.

Mr. Philpott also showed that while the cost per carboy of the substitutes was in several cases less than the price which the government had fixed for the same amount of acetic acid, the coagulating power of the former was so much less, as in the end to make them much more expensive to use than acetic acid.

Ceylon Clones

The first quarterly circular for 1940 from the Rubber Research Scheme (Ceylon), discusses the yields of Ceylon clones in 1939 in test tappings and semi-commercial tappings at the Nivitigalakele Experiment Station and on Stennes and Millakanda Estates.[2] Last year, the report says, in general

[1] "War-Time Coagulants. A Note on Proprietary Substitutes," *Rubber Research Scheme (Ceylon)*, Mar., 1940, pp. 24-27.
[2] "Ceylon Clones VIII 1939)." C. E. Ford, *Rubber Research Scheme (Ceylon)*, Mar., 1940, pp. 1-13.

was a poor one for crop owing chiefly to unfavorable distribution of rainfall, and several clones showed a decrease in yield as compared with 1938, while in others only small increases occurred. However the data showed that the best Ceylon clones are capable of yields as good as those of the best imported clones.

The three highest yielding Ceylon clones are Millakanda 3/2, Wagga 6,278, and Hillcroft 28. The members of these clones here considered were 8½ to 9 years old. The yields in test tappings of Millakanda 3/2 showed an increase in 1939 of 40%, this when most clones were barely maintaining their yields. The average of ten trees amounted to 15.6 pounds per tree per annum; 66 trees of the same clone gave an average of 10.1 pounds per tree for the year, or at the rate of 1,240 pounds per acre per annum. Because it is so free from serious defects and yields so well, this clone is recommended for large-scale planting.

Hillcroft 28 also gives high yields, but because of its susceptibility to brown bast it is at present only recommended for use on a small scale.

The yield of Wagga 6,278 at Nivitigalakele fluctuated very considerably from month to month in 1939; nevertheless the high average of 13.7 pounds per tree per annum was obtained. If the yield shows a satisfactory increase in 1940 and no important defects develop, this clone will probably be recommended for large-scale planting under conditions similar to those prevalent at the experiment station. At present it is approved for small-scale planting only.

NETHERLAND INDIA

To render Java self-sufficient in the matter of foodstuffs, the government is planning to introduce a measure enforcing the interplanting of foodstuffs, especially rice, in young rubber areas. This has caused some apprehension in rubber circles as it is feared that such interplanting would not only lead to damage by wild animals, but would also impoverish the soil and interfere with the growth of the rubber. In the Bantam district a few tests were made to determine the effect of interplanting with rice, and so far tests seem to reveal some retardation in the growth of young rubber. However it is considered that the tests have not been conducted long enough or on a sufficiently wide scale to come to a definite conclusion in this regard. Wild beasts have caused a certain amount of damage in the fields, but the rubber trees themselves were not harmed. On the financial side, there was a profit per hectare of 5.63 guilders from rice grown on a replanted area and of 14.73 guilders on a new clearing, and that in a season considered unfavorable for rice growing. Estates may therefore have the advantage of at least securing cheap rice for their coolies, which means, they can count on cheap labor.

BRITISH INDIA

To conserve exchange, imports into India of a wide variety of goods from non-Empire sources and of a few also from Empire sources are to be limited to amounts necessary to meet vital requirements. These goods will not be allowed to enter without import licenses, which, it is understood, will be granted on the basis of unpublished and tentative quotas representing percentages of imports during the year ended August 31, 1939. Among the goods for which licenses will be required are motor vehicles and accessories, and rubber tires and other manufactures of rubber from Empire as well as from foreign countries. The import quota for motor trucks may be more liberal than for passenger cars; for the former they will probably be more than 50% of imports in the base year.

Editor's Book Table

NEW PUBLICATIONS

"Spray Engineering." Spray Engineering Co., 114 Central St., Somerville, Mass. 16 pages. The company's standard industrial spraying equipment is briefly described in this booklet, together with catalog and bulletin references for obtaining more complete information. The following equipment is covered: spray nozzles, air washers, spray cooling systems, humidifying systems, moistening equipment, finishing machines, powder blowers, and spray accessory equipment. Among the uses listed are: rubber mill roll cooling, applications of adhesives, latex and coagulant application, and lubricating rubber molds.

"Cambridge Electron-Ray pH Meter." Cambridge Instrument Co., Inc., 3732 Grand Central Terminal, New York, N. Y., 4 pages. In this leaflet is described the firm's laboratory pH meter which features an electron-ray null-indicator. An electron-ray tube, having a variable-width beam on a fluorescent screen, is used instead of a galvanometer. A glass electrode is employed, and one model operates from a 110-125 volt A.C. line, a second model from dry batteries.

"Portable Recording Voltmeters and Ammeters." Bulletin 555. The Bristol Co., Waterbury, Conn. The features incorporated to make these recorders moisture-proof and rugged are described in this bulletin. Two-and three-pen instruments as well as single-recording instruments are illustrated.

"Esso Oilways." June, 1940. Esso Oilways, 26 Broadway, New York, N. Y. 24 pages. An interesting article, featured in this issue, is entitled, "America Puts on its Rubbers," and includes brief discussions on Pliofilm, Tensolite, Perbunan, neoprene, Vistanex, Resistoflex, "Thiokol," Koroseal, and AXF. "Virginia's Titan" is the title of an article dealing with the mining and production of rutile and ilmenite, titanium dioxide ores, in America's only mine of this type. Another story in this issue traces the development and history of hydraulic machines of various types.

"Green Book Buyers Directory," 1940-41 Edition. Oil, Paint and Drug Publishing Co., Inc., 59 John St., New York, N. Y. 1,004 pages. The twenty-eighth annual edition of this directory provides an informative service for industrial buyers and sellers of chemicals, oils, and drugs. The book gives the name of the material, equipment, etc., followed by the name and address of the manufacturer. The customary division of contents is continued: (1) industrial materials; (2) industrial equipment, containers, and other supplies; (3) professional, technical, and commercial services; (4) trade names and brand names; (5) a record of United States imports and exports of the principal chemicals and related materials for the years 1938 and 1939. Manufacturers of rubber and latex compounding ingredients and supplies are listed.

"Better Paints and Materials for Better Maintenance." Catalog VIII. The Skybryte Co., 3125 Perkins Ave., Cleveland, O. 20 pages. The firm's line of industrial paint products discussed in this catalog includes: general purpose aluminum paint with a Bakelite base; machinery enamel; window coating for reducing glare; aluminum and black paints resistant to heat, acids, and alkalis; flat-finish casein paint; oil-base wall paint; fence paint; concrete and masonry paint; concrete floor enamel with a base of resin and crepe rubber; factory window glass cleaner; protective waxes; primer for rusted surfaces; damp- and stain-proofing compound for concrete, stucco, etc.; and a Bakelite-containing clear varnish.

"The Story of St. Joe Electro-Thermic Zinc." St. Joseph Lead Co., 250 Park Ave., New York, N. Y. 24 pages. This booklet contains reprints of 12 advertisements which tell the story of the production of electro-thermic zinc from the ores obtained from the firm's own mines in New York State. Pertinent statistics regarding zinc and zinc oxide production are also included.

"The Trade of Latin America with the World and with the United States." Part I. United States Tariff Commission, Washington, D. C. According to this report, United States exports to Latin America in the six-month period, September, 1939, to February, 1940, were 54% greater than in the same period 1938-39, and imports from Latin America were 32% greater. In the same period United States exports to all countries increased only 33%, and imports 27%. In recent years Latin America has usually accounted for about one-fifth of the foreign trade of the United States. Part I of the report, released May 10, deals with the trade of Latin America as a whole; Part II, to follow, will deal with the trade of the 20 Latin American republics; and Part III will cover approximately 30 selected Latin American export commodities.

"Boiler and Tank Accessories." Catalog No. 10. The Steel Improvement & Forge Co., Cleveland, O. 40 pages. Accessories for fired and unfired pressure vessels are presented in this catalog, together with technical data, photographs, dimension drawings, sizes, and prices. The equipment covered includes: manhole and handhole covers and assemblies, forged flanges and gaskets, and pipe fittings suitable for welding.

"List of Inspected Electrical Equipment." Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill. 476 pages. This list, revised semi-annually, includes all listings up to May 1, 1940. The equipment listed has been examined with reference to fire and accident hazards and for conformity with the provisions of the National Electrical Code applying to their installation and use.

"Rex-Weld and Rex-Tube Flexible Metal Hose." Catalog G-21. Chicago Metal Hose Corp., Maywood, Ill. 40 pages. Besides detailed illustrations and descriptions this booklet also gives much technical data covering the use of flexible metal hose for saturated steam and superheated steam, for the conveyance of fluids and chemicals, and numerous special uses as vibration absorbers for compressors, pumps, and turbines, compensators for high-temperature pipe lines, and equalizer connections for gas burning furnaces. Treated, too, are developments in flexible metal hose engineering: Rex-Bellows and C. M. H. stainless steel bellows with fittings attached for electric resistance circumference seam welding; Avioflex for fuel lines; and RW-89 all-steel exhaust hose. The Avioflex hose for oil connections utilizes a synthetic rubber cover.

"War-Time Increase in Transportation Costs of Principal Imports." United States Tariff Commission, Washington, D. C. This report shows the relation of current to pre-war transportation costs for imports of about 200 commodities, including rubber, which are important in the economy of this nation. The war-time increases in ocean freight costs and war risk insurance rates for the shipment of these goods from overseas origins to the United States are also listed. Rates on rubber and tin from the Far East have advanced, but the ocean freight amounts to only a small percentage of the value of these materials.

"Latex Seamless Products." Latex Seamless Products Co., 4620 E. Washington Blvd., Los Angeles, Calif. 4 pages. Rubber or neoprene latex is deposited over the surface of metal articles and then vulcanized, according to this folder. Products so treated, which are illustrated here, include: parts for the aviation and automobile industry, tanks and containers; pipe and pipe fittings; pumps; blowers; plating racks and dipping baskets; acid buckets; and kitchen equipment.

"The Vanderbilt News." July-August, 1940. R. T. Vanderbilt Co., 230 Park Ave., New York, N. Y. 28 pages. This entire issue of the *News* is devoted to Ty-Ply, a non-tacky adhesive for bonding rubber and synthetic rubber-like materials to metal during vulcanization. Rubber, neoprene, "Thiokol," and butadiene rubber compounds are given, together with physical test data which include the adhesion of these compounds to steel by means of a Ty-Ply bond. The bonding of rubber and neoprene to aluminum is also discussed and a summary table evaluates Ty-Ply adhesion to different metals.

"Fracture Splints, Braces, Abdominal Belts, Trusses, and All Allied Products." Ambulatory Pneumatic Splint Mfg. Co., 1861 W. Ogden Ave., Chicago, Ill. 16 pages. This booklet describes a duralumin leg splint with a pneumatic boot for cushioning. Various types of elasticized supporters and surgical hosiery are also covered.

"A Complete Line of Stoppers." R. W. Rhoades Metaline Co., Inc., Long Island City, N. Y. 8 pages. This illustrated folder features laboratory stoppers made of neoprene. Also included are descriptions and specifications for stoppers of gray, red antimony, and floating pure gum rubber; Kjeldahl stoppers; and Bailey and Walter Crucible holders.

"Reference Manual of Latin American Commercial Treaties." United States Tariff Commission, Washington, D. C. The Manual, for the first time, lists in complete detail the bilateral commercial treaties and agreements negotiated by the 20 Latin American countries during their entire history.

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Patents and Trade Marks

MACHINERY

United States

2,203,543. **Rubber Heel Mold.** M. Pancorbo, New York, N. Y.

2,204,270. **Surge Valve** for Hydraulic Press. R. W. Dinzl, Westfield, assignor to Watson-Stillman Co., Roselle, both in N. J.

2,204,513. **Safety Control** for Vulcanizer Presses. R. A. F. Sandberg and P. F. K. Erbguth, both of Brooklyn, and E. S. Smith, Jr., St. Albans, assignors to Charles J. Tagliabue Mfg. Co., Brooklyn, all in N. Y.

2,204,531. **Safety Control for Vulcanizer Presses.** P. F. K. Erbguth and R. A. F. Sandberg, both of Brooklyn, and E. S. Smith, Jr., St. Albans, assignors to Charles J. Tagliabue Mfg. Co., Brooklyn, all in N. Y.

2,204,617. **Apparatus and Method for Internally Electrically Heating Expanding Rubber.** F. W. Peel, Severna Park, and C. J. Kilduff, Baltimore, both in Md.

2,204,782. **Apparatus and Method for Making Divisible Duplex Insulated Wires.** H. H. Wermine, Villa Park, assignor to Belden Mfg. Co., Chicago, both in Ill.

2,205,112. **Continuous Vulcanizer** for Strip Material. A. L. Wallace, Northport, N. Y., assignor, by mesne assignments, of one-half to A. L. Wallace and one-half to Cherryfield Corp., a corporation of Del.

2,204,168. **Tire Indicator.** G. G. Guthrie, Tulsa, Okla.

2,205,518. **Extruding Head** for Flat Strip. G. E. Duffy, Port Clinton, assignor to Standard Products Co., Cleveland, both in O.

2,205,791. **Hydraulic Press.** R. W. Dinzl, Westfield, N. J., assignor, by mesne assignments, to Baldwin Locomotive Works, a corporation of Pa.

2,205,939. **Tire Retreader.** P. D. Wilson, Danville, Ill.

Dominion of Canada

389,362. **Rubbing Base Valve Buffing and Polishing Machine.** Wingfoot Corp., Wilmington, Del., assignee of E. D. George and H. M. Brown, co-inventors, both of Cuyahoga Falls, O., both in the U. S. A.

389,408. **Tire Grooving Tool.** E. H. Stackhouse, Philadelphia, Pa., U. S. A.

389,600. **Textile Fiber Treating Apparatus.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of B. H. Foster, Maplewood, N. J., U. S. A.

United Kingdom

518,153. **Apparatus and Methods for Making Battery Paste Retainers.** United States Rubber Products, Inc.

518,257. **Apparatus for Drying a Continuous Web of Material.** Firestone Tire & Rubber Co., Ltd.

PROCESS

United States

2,202,846. **Copolymers of Polyallyl Esters and Polymerizable Unsaturated Compounds.** B. S. Garvey, Akron, and C. H. Alexander, Cuyahoga Falls, both in O., assignors to B. F. Goodrich Co., New York, N. Y.

2,203,072. **Rubber Medical Appliance** Comprising a Hollow Applicator with Connecting Tubes. R. W. Albright, assignor American Anode, Inc., both of Akron, O.

2,203,283. **Foil Condenser** Utilizing a Dielectric of Rubber and an Oxidized Vegetable Oil. R. L. Miller, Lincoln, Ill.

2,203,377. **Golf Balls** with Cover Locked to Body by Embedded Fibrous Strands. L. A. Young, Detroit, Mich.

2,203,387. **Assembling Rubber Filaments into Thread.** R. G. James, Wylde Green, Birmingham, assignor to Dunlop Rubber Co., Ltd., London, both in England.

2,203,622. **Covered Rubber Thread.** G. S. Van Voorhis, Northampton, assignor to United Elastic Corp., Easthampton, both in Mass.

2,203,701. **Preparing Rubber Threads in Relatively Inelastic Form.** (Latex.) T. L. Shepherd, London, England.

2,203,752. **Typewriter Platen.** B. L. Smith, Los Angeles, Calif.

2,204,147. **Making upon a Thin Sheet of Translucent Rubber a Strongly Adherent Photographic Image.** A. Murray, Rochester, N. Y., assignor, by mesne assignments, to Eastman Kodak Co., Jersey City, N. J.

2,204,366. **Carbon Black.** W. A. Knapp, Monroe, La., assignor to Imperial Oil & Gas Products Co., Pittsburgh, Pa.

2,204,383. **Printing Rolls.** M. M. Safford, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,204,468. **Forming Inner Tubes.** G. C. Berryman, Los Angeles, Calif.

2,204,622. **Windlace Cord** from Expanded Rubber. J. S. Reid, Cleveland, O., assignor to Rubatex Products, Inc., New York, N. Y.

Dominion of Canada

389,361. **Producing Film from Rubber Hydrohalide Cements.** Wingfoot Corp., Wilmington, Del., assignee of G. R. Lyon, Akron, O., both in the U. S. A.

389,363. **Rubber Hydrochloride Film Production.** Wingfoot Corp., Wilmington, Del., assignee of H. J. Osterhof, Cuyahoga Falls, O., both in the U. S. A.

389,364. **Rubber Hydrochloride Film Production.** Wingfoot Corp., Wilmington, Del., assignee of L. B. Sebrell, Silver Lake, O., both in the U. S. A.

389,456. **Treatment of Artificial Cellulosic Cords in Tire Manufacture.** E. I. du Pont de Nemours & Co., Wilmington, Del., assignee of A. Hershberger, Buffalo, N. Y., both in the U. S. A.

United Kingdom

517,609. **Rubber-Flooring Material.** G. MacLellan & Co., Ltd., and A. J. Dee.

517,663. **Molded Slabs, Etc.,** for Insulating Purposes. J. McArthur.

517,693 and 517,694. **Hollow Rubber Articles.** R. W. Sampson.

518,056. **Artificial Dentures and Dental Plates.** Soc. Anon. De Trey Freres.

Germany

691,012. **Printing Dark Colored Lengths of Rubber.** Harburger Gummiwaren-Fabrik Phoenix A.G., Hamburg-Harburg.

691,186. **Insulated Cables and Wires.** G. Fodor, Paris, France. Represented by R. E. Muller, Berlin-Charlottenburg.

CHEMICAL

United States

2,202,934. **Antioxidants**—Production of Aliphatic Ketone-Diarylamines. W. F. Tuley, Naugatuck, C. S. Dewey, Cheshire, and R. S. Hanslick, Naugatuck, all in Conn., assignors, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,203,090. **Accelerator**—a Pyrinidine-4-Sulphide. L. H. Howland, Nutley, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,203,597. **Box Toe Material** Comprising an Absorbent Base Impregnated with a Composition of a Rubber Derivative, Resin, and Wax. H. B. Morse, Binghamton, and W. S. Cornell, Endicott, assignors to Endicott Johnson Corp., Endicott, all in N. Y.

2,203,677. **Pressure Sensitive Adhesive** Comprising Raw Rubber and Ester Gum Dispersed in a Volatile Vehicle. R. G. Drew, assignor to Minnesota Mining & Mfg. Co., both of St. Paul, Minn.

2,203,866. **Raising the Surface Tension of Uncompounded Latex** by Addition of a Salt of an Alkaline-Earth Metal. W. A. Gibbons, Montclair, and J. McGavack, Leonia, both in N. J., assignors, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,203,873. **High Molecular Weight Polymers** from Highly Purified Iso-olefins. (Synthetic.) M. Mueller-Cunradi, Ludwigshafen-on-the-Rhine, and M. Otto, Oppau, assignors to I. G. Farbenindustrie Akt.-Ges., Frankfurt a.M., all in Germany.

2,203,899. **Antioxidant—a** 1,2-Dihydroquinoline. R. F. Dunbrook and B. J. Humphrey, assignors to Firestone Tire & Rubber Co., all of Akron, O.

2,204,113. **Friable Precipitated Calcium Silicate** with Particle Size of about 0.3-Micron. R. P. Allen, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,204,135. **Chlorination of Ketones.** P. C. Jones, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,204,157. **Catalyst for Dehydrating 1.3 Butanediol.** W. L. Semon, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,204,167. **Solvent** for High Molecular Weight Polymers of Isobutylene—an Aliphatic Ester of an Organic Fatty Acid. P. J. Wiezevich, Elizabeth, N. J., now by judicial change of name Peter J. Gaylor, assignor to Standard Oil Development Co., a corporation of Del.

2,204,870. **Antioxidant**—Compound with the Formula $R-\overset{H}{\overset{|}{N}}-R'-\overset{X}{\overset{|}{N}}-R$ Where R′ Is an Arylene Radical, R Is an Aryl Radical, and X is a Benzyl or Alkyl Group. R. L. Sibley, Nitro, W. Va., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,205,070. **Vulcanizing Rubber** in the Presence of an Aryl Thiazyl 2-Selenide Compound. W. Scott, Akron, O., assignor to Wingfoot Corp., Wilmington, Del.

2,205,084. **Antioxidant**—Reaction Product of a Quinone and a Naphthol. A. M. Clifford, Stow, O., assignor to Wingfoot Corp., Wilmington, Del.

2,205,100. **Vulcanizing Rubber** in the Presence of the Reaction Product of a Dithio Acid and a Halo Ketone. J. G. Lichty, Stow, O., assignor to Wingfoot Corp., Wilmington, Del.

2,205,101. **Vulcanizing Rubber** in the Presence of the Reaction Product of Sulphur and a 2-Amino Benzothiazole. J. G. Lichty, Stow, O., assignor to Wingfoot Corp., Wilmington, Del.

2,205,108. **Elastic Composition** Comprising Polyisobutylene and a Cyclic Polymer Obtained from Unsaturated Hydrocarbons. (Synthetic.) R. Rosen, Elizabeth, N. J., assignor to Standard Oil Development Co., a corporation of Del.

2,205,159. **Polymerization of Olefins** in the Presence of a Strong Acid Catalyst. (Synthetic.) D. R. Stevens, Swissvale, and W. A. Gruse, Wilkinsburg, both of Pa., assignors to Gulf Research & Development Co., Wilmington, Del.

2,205,239. **Cyano-2-Butadiene-1,3 and Its Polymers.** (Synthetic.) A. S. Carter and F. W. Johnson, assignors to E. I. du Pont de Nemours & Co., all of Wilmington, Del.

2,205,390. **Copolymers of Styrene and 2-Chloroallyl Esters.** (Synthetic.) E. C. Britton, G. H. Coleman, and J. W. Zemba, assignors to Dow Chemical Co., all of Midland, Mich.

2,205,449. **Increasing the Tensile Strength of Vinylidene Chloride Polymers.** (Synthetic.) R. M. Wiley, assignor to Dow Chemical Co., all of Midland, Mich.

2,205,654. **Dielectric Composition** Comprising a Mixture of Polyvinyl Chloride and Rubber Hydrochloride with a Mutual Plasticizer Present. R. W. Ide, Jr., Gary, Ind., and H. A. Winkelmann, assignors to Marbon Corp., both of Chicago, Ill.

2,205,699. **Synthetic Rubber** from the Gases and Distillation Products of Vegetable Matter, Mineral Oils, Etc., Mixed with Acetylene Gas. J. J. Earshen, also known as M. I. Ousheff, Buffalo, N. Y.

Dominion of Canada

389,138. **Preparation of Mercapto-Aryl-Thiazole.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. E. Messer, Cheshire, Conn., U. S. A.

389,139. **Metal Surface Protection** with Asbestos Cloth and Chlorinated Rubber. Dominion Rubber Co., Ltd., assignee of J. A. Porteous, both of Montreal, P. Q.

389,614. **Vulcanization Retarder** for a Polymerized Halogen-2-Butadiene-1, 3 Composition. B. F. Goodrich Co., New York, N. Y., assignee of R. A. Crawford, Akron, O., both in the U. S. A.

United Kingdom

517,451. **Accelerators.** Monsanto Chemical Co.

517,689. **Improving the Stability to Heat of Shaped Polyvinyl Chloride.** (Synthetic.) W. W. Groves, (I. G. Farbenindustrie A.G.).

517,761. **Rubber Compositions.** Standard Telephones & Cables, Ltd.

517,951. **Synthetic Rubber-Like Masses.** I. G. Farbenindustrie A.G.

518,027. **Vinyl-Type Resin Compositions.** (Synthetic.) Armour & Co.

518,099. **Stabilization of Polyvinyl Resins.** (Synthetic.) Kodak, Ltd.

518,158. **Preservation of Rubber, Oils, and Other Oxidizable Substances.** T. A. Clayton, (United States Rubber Co.).

518,160. **Vulcanization of Rubber.** Consolidated Rubber Manufacturers, Ltd.

GENERAL

United States

21,483 (Reissue). **Shock Reducing and Cushioning Wheel Mounting** for Vehicles. G. L. Larison, La Grande, Ore.

2,202,908. **Machinery Packing.** C. R. Hubbard, assignor to Garlock Packing Co., both of Palmyra, N. Y.

2,202,918. **Independent Wheel Suspension** with Rubber Bearing Pad. R. F. Peo and S. C. Bliss, assignors to Houde Engineering Corp., all of Buffalo, N. Y.

2,202,929. **Rubber-Cushioned Tilling Implement.**

W. H. Silver, assignor to Deere & Co., both of Moline, Ill.

2,202,932. **Filtering Apparatus.** H. C. Tingey, Nutley, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.

2,202,940. **Yieldable Mounting.** A. P. Armington, Willoughby; K. S. Armington, executrix of A. P. Armington, deceased, assignor to Euclid Road Machinery Co., Euclid, all in O.

2,203,052. **Partition for Sinks.** F. A. Hanson, Los Angeles, Calif.

2,203,071. **De-Icing Windshield Wiper.** M. Zaiger, Swampscott, Mass.

2,203,078. **Expansion Joint** for Concrete Roads. J. E. Carter, Geneseo, Ill.

2,203,106. **Mop.** K. S. Rogers; F. J. Miller, administrator of K. S. Rogers, deceased, assignor, by mesne assignments, to L. C. Rogers, all of Miles, Mich.

2,203,124. **Inner Tube** Divided into Separate Compartments. W. B. Barry, San Francisco, Calif.

2,203,133. **Detachable Spout** for Containers. J. B. Englert, Akron, O.

2,203,163. **Oil Seal.** S. C. Leonard, Jr., Detroit, Mich.

2,203,164. **Shaft Seal.** S. C. Leonard, Jr., Detroit, Mich.

2,203,185. **Suction and Force Cup.** A. Walus, Brooklyn, N. Y.

2,203,203. **Rubber-Covered Live Bait Box.** E. M. Lyon, Bozeman, Mont.

2,203,259. **Inflatable Portable Football Dummy.** M. J. Gilman, Gilman, Conn.

2,203,274. **Elastic Coating** for Tree Cavities. (Latex.) W. J. Anderson and S. S. Rosen, assignors to Protex Industries, Inc., all of New York, N. Y.

2,203,290. **Motor Vehicle Wheel Support.** F. C. Best, assignor to Packard Motor Car Co., both of Detroit, Mich.

2,203,308. **Anti-Skid Finger Clip** for Handling Sheet Material. G. H. Rives, assignor to Rives Neverslip, Inc., both of Brooklyn, N. Y.

2,203,313. **Dispensing Container.** P. M. Thorn, New Rochelle, N. Y.

2,203,342. **Spring Device** for Vehicle Wheel Suspension. C. M. Sloman, and H. Hierta, assignors to Briggs Mfg. Co., all of Detroit, Mich.

2,203,344. **Vehicle Wheel Suspension.** J. Tjaarda, Birmingham, assignor to Briggs Mfg. Co., Detroit, both of Mich.

2,203,346. **Windshield Wiper.** J. W. Anderson, assignor to Productive Inventions, Inc., both of Gary, Ind.

2,203,364. **Sealing Means** for High Pressure Heads. J. P. Rathbun, Prospect Park, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, both in Pa.

2,203,402. **Cushioned Spectacle Case.** C. L. Bausch, assignor to Bausch & Lomb Optical Co., both of Rochester, N. Y.

2,203,413. **Automobile Armrest.** H. M. Hood, Chicago, Ill., assignor to Featheredge Rubber Co., Inc., a corporation of Ill.

2,203,426. **Wringer.** J. W. Brandt, assignor to Lovell Mfg. Co., both of Erie, Pa.

2,203,479. **Washing Machine.** W. J. Witwer and A. C. Bunyan, assignors to B. W. B. Co., all of Cleveland, O.

2,203,480. **Pickling and Cleaning Device** for strips of Sheet Metal. P. J. Wood, Riverside, assignor to Goodman Mfg. Co., Chicago, both in Ill.

2,203,542. **Cuhioning Mechanism** for a Railway Car. H. D. Page, Flushing, assignor to Waugh Equipment Co., New York, both in N. Y.

2,203,562. **False Face.** G. L. Edwards, Fuquay Springs, N. C.

2,203,564. **Water Gate** for Pneumatic Tractor Tires. H. A. Farnsworth, Elkhart, Kans.

2,203,591. **Flexible Refrigerating Package.** C. F. Brown, Chicago, Ill.

2,203,617. **Tractor Tire** for Muddy Soil Operation. J. E. Hale, assignor to Firestone Tire & Rubber Co., both of Akron, O.

2,203,633. **Waxed Wrapping Paper.** (Latex.) C. M. Rhodes, St. Paul, assignor to Rapinwax Paper Co., Minneapolis, both in Minn.

2,203,669. **Internal Combustion Engine Charge-Forming Device.** F. D. Butler, U. S. Navy.

2,203,724. **Engine Starter** with Rubber Collar Drive. J. W. Fitz Gerald, assignor to Briggs & Stratton Corp., both of Milwaukee, Wis.

2,203,754. **Packing Ring** for Hydraulic Operator. G. T. Thomas, Birmingham, Mich.

2,203,774. **Vehicle Wheel.** A. J. Cornelissen, Buffalo, N. Y.

2,203,797. **Storage Battery** with a Removable Vent Plug and Filler Cap. C. E. Pearson, Cleveland Heights, assignor to Willard Storage Battery Co., Cleveland, both in O.

2,203,891. **Denture Demonstrating Apparatus.** G. H. Burtenshaw, Taumarunui, N. Z.

2,203,903. **Container** for Electrolytic Condensers. A. M. Georgiev, Dayton, O., assignor to General Motors Corp., Detroit, Mich.

2,203,965. **Cushioned Railway Car Wheel.** S. M. Nampa, Detroit, Mich., assignor by mesne assignments, to Transportation Systems, Inc., Oklahoma City, Okla.

2,203,976. **Massaging Device.** S. Aoyagi, Hilo, Hawaii.

2,204,038. **Eraser Feeding Device.** G. Findra, New Brunswick, N. J.

2,204,088. **Closure Device** for Battery Box Covers. K. K. Kugler, Culbertson, Neb., assignor to American Hard Rubber Co., New York, N. Y.

2,204,122. **Surface-Protective Apparatus** to Prevent Ice Accumulation. R. S. Colley, Kent, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,204,156. **Continuous Reactor for Corrosive Reagents.** W. L. Semon, Silver Lake Village, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,204,159. **Cushioned Platform Shoe.** A. C. Sewall, Auburn, Me.

2,204,202. **Cosmetic Applicator** of Porous Rubber. C. E. Zimmerman, Chicago, Ill.

2,204,203. **Cosmetic Applicator** of Porous Rubber. (Latex.) C. E. Zimmerman, Chicago, Ill.

2,204,235. **Anti-Thumb-Sucking Device.** D. D. Shelton, Portland, Oreg.

2,204,274. **Wax Paper Folding Machine.** F. M. Hitner, Detroit, Mich.

2,204,302. **Wringer Feed.** G. Czefra, Chicago, Ill.

2,204,316. **Shock-Absorbent Electric Lamp Fixture.** P. W. Miller, McKeesport, and W. A. Trosen, Clairton, both of Pa.

2,204,361. **Hair Curler.** W. Huppert, New York, N. Y., assignor to Delamere Co., Inc., a corporation of Del.

2,204,448. **Container Venting Means.** C. J. Schmid, assignor to Julius Schmid, Inc., both of New York, N. Y.

2,204,466. **Mixture of Calcium Chloride, Alum, and Borax,** Applicable to Tires, Footwear, Etc., to Prevent Skidding. H. T. Barnes, assignor to G. F. Foss, both of Montreal, P. Q., Canada.

2,204,507. **Sealing Ring** for Conduit Joint. J. A. Martin, assignor to Vickers, Inc., both of Detroit, Mich.

2,204,510. **Resilient Compressor Mounting.** C. R. Neeson, Dayton, O., assignor, by mesne assignments, to Chrysler Corp., Highland Park, Mich.

2,204,524. **Fluid Discharge Device** for Containers. C. P. Bender, Wabash, Ind., assignor to General Tire & Rubber Co., Akron, O.

2,204,648. **Packing for Well Devices.** R. C. Baker, Coalinga, assignor to Baker Oil Tools, Inc., Huntington Park, both in Calif.

2,204,654. **Syringe.** K. H. Booty, assignor to Sears, Roebuck & Co., both of Chicago, Ill.

2,204,683. **Device for the Simultaneous Sterilization** of a Nursing Bottle and Its Nipple. G. Lambert, Lyon, France.

2,204,698. **Engine Starter.** R. G. Rinot, Paris, France.

2,204,701. **Toy Multitone Siren.** H. Robinson, Wayne, Pa.

2,204,707. **Bicycle Lamp.** A. J. Seiss, Toledo, O.

2,204,723. **Support and Drape** for Casket Lowering Devices. F. M. Compton, Waco, Tex.; I. M. Compton, executrix of F. M. Compton, deceased.

2,204,731. **Plain Knitted Ornamented Fabric** Having Elastic Thread Incorporated Therein. J. L. Getaz, Maryville, Tenn.

2,204,737. **Electric Cable** for Transmission of High Frequency Impulses. J. C. Swallow, Northwich, and M. W. Perrin, London, assignors to Imperial Chemical Industries, Ltd., all in England.

2,204,738. **Resusitator.** H. L. Swan, Lake Village, Ark.

2,204,764. **Thermometer Attachment** for Fountain Syringe Bags. R. R. Mayo, New York, N. Y., assignor of one-half to A. L. Stover, Bradford, Pa.

2,204,769. **Windshield Frame.** A. T. Potter, assignor to Ainsworth Mfg. Co., both of Detroit, Mich.

2,204,778. **Marking Implement.** F. A. Sturm, Paterson, N. J.

2,204,789. **Percussion Toy.** M. Bredow, Waterloo, Iowa.

2,204,895. **Bathing Cap with Sealing Flange.** J. C. Johnson, Rockford, Ill.

2,204,928. **Locking Device** for Fabric. E. S. Culver, Oakland, assignor to Oliver United Filters, Inc., San Francisco, both in Calif.

2,204,953. **Resilient Car Wheel.** J. J. Wittmer, Cleveland Heights, assignor to National Malleable & Steel Castings Co., Cleveland, both in O.

2,204,988 and 2,204,989. **Suspension Means** for Auto Drive Axles. J. Haltenberger, Ann Arbor, Mich.

2,205,025. **Cushioned Tip** for Shuttles. R. Balfour, Dundee, Scotland.

2,205,044. **Safety Step Tread** for Buses. S. D. Moore, Cleveland, O.

2,205,057. **Casket Placer.** J. R. Brady, assignor to Marion Metal Products Co., both of Marion, O.

2,205,098. **Snubber.** J. A. Lamont, assignor to American Steel Foundries, both of Chicago, Ill.

2,205,102. **Model Test Piece.** O. W. Loudenslager, Akron, and L. H. Donnell, Cuyahoga Falls, assignors to Goodyear-Zeppelin Corp., Akron, all in O.

2,205,137. **Wringer Release Mechanism.** N. L. Etten, assignor to Chamberlain Corp., both of Waterloo, Iowa.

2,205,161. **Grip Exerciser.** A. D. Vick, Washington, D. C.

2,205,200. **Comb.** W. Huppert, New York, N. Y., Assignor to Delamere Co., Inc., a corporation of Del.

2,205,260. **Tire Guard.** F. A. Hart, New York, N. Y.

2,205,347. **Hose Clamp.** F. L. Darling, Hollywood, Calif., assignor to A. E. Dieterich, Washington, D. C.

2,205,356. **Shoe** of Elastic Material. R. Gruensfelder and E. C. Neunuebel, both of St. Louis, Mo.; Neunuebel assignor to Gruensfelder.

2,205,521. **Assembly for Brakes.** T. L. Fawick, Akron, O., assignor to Fawick Co., Inc., Wabash, Ind.

2,205,524. **Rubber-Coated Paper Clip.** W. J. Gareis, New Ulm, Minn.

2,205,577. **Shoe Adjustable** to the Foot. E. F. Roberts, Rye, assignor, by mesne assignments, to United States Rubber Co., New York, both in N. Y.

2,205,626. **Measuring Device** to Determine the Symmetrical Size of a Pair of Limbs. F. E. Mason, White River Junction, Vt.

2,205,652. **Vehicle Wheel.** H. J. Horn, assignor to Motor Wheel Corp., both of Lansing, Mich.

2,205,661. **Radiator Cover.** H. T. Kraft, assignor to General Tire & Rubber Co., both of Akron, O.

2,205,689. **Traction Apparatus** for Motor Vehicle Wheels. A. L. Fischer, Portland, Me.

2,205,703. **Drain Stopper.** H. Trotman, Bayside, N. Y.

2,205,746. **Automobile Tire Jack or Dolly.** L. L. Judge, Baltimore, M. D.

2,205,790. **Stocking.** A. J. Cobert, assignor to Real Silk Hosiery Mills, Inc., both of Indianapolis, Ind.

2,205,802. **Pit Mat** for Bowling Alleys. H. B. Scheidemantel, Muskegon, and H. J. Luth, Muskegon Heights, both in Mich., assignors to Brunswick-Balke-Collender Co., Chicago, Ill.

2,205,810. **Construction Joint for Concrete.** J. E. Carter, Geneseo, Ill.

2,205,825. **Closure** for Ink Containers. R. S. Skinner, Sentinel, Okla.

2,205,910. **Coupling Compression Ring.** F. J. Raybould Erie, assignor to Raybould Coupling Co., Meadville, both in Pa.

2,205,912. **Rubber Heel and Tread.** C. F. Snyder, Pittsburgh, Pa.

2,205,929. **Pencil Eraser Attachment.** J. R. Musgrave, Shelbyville; Peoples National Bank, Shelbyville, and Third National Bank, Nashville, administrators of J. R. Musgrave, deceased, assignors to Musgrave Pencil Co., Inc., all in Tenn.

2,205,992. **Storage Battery.** J. L. Phillips, assignor to Electric Storage Battery Co., both of Philadelphia, Pa.

Dominion of Canada

389,068. **Adhesive Bandage.** A. and S. Baitz, co-inventors, both of Royal Park, Victoria, Australia.

389,085. **Pile Fabric.** G. S. Hiers, Bala Cynwyd, Pa., U. S. A.

389,099. **Shaft Coupling.** L. Ricefield, Oak Park, Ill., U. S. A.

389,164. **Shock Absorbing Mechanism.** W. H. Miner, Inc., assignee of G. A. Johnson and E. H. Lehman, co-inventors, all of Chicago, Ill., U. S. A.

389,168. **Liquid Atomizing Device.** (Synthetic.) Parks-Cramer Co., Fitchburg, assignee of H. F. Simon, Lunenburg, both in Mass., U. S. A.

389,197. **Pantie Girdle.** A. Stein & Co., Chicago, assignee of C. Bullinger, Riverside, both in Ill., U. S. A.

389,248. **Brush and Bristles.** Marogg Products Corp., Dover, Del., assignee of R. Marogg, New York, N. Y., both in the U. S. A.

389,253. **Fountain Pen Filling Device.** O. R. Terry, Detroit, Mich., U. S. A.

389,284. **Magnet Wire Insulating Apparatus.** Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of J. J. Keyes, Pittsburgh, Pa., U. S. A.

389,318. **Footwear.** B. F. Goodrich Co., New York, N. Y., assignee of L. H. L'Hollier and F. F. Olson, co-inventors, both of Belmont, Mass., both in the U. S. A.

389,324. **Panel Mounting.** Hunter Sash Co., Inc., assignee of L. G. Hunter, both of Flushing, L. I., N. Y., U. S. A.

389,325. **Machine Gun Control System.** India Rubber, Gutta Percha & Telegraph Works Co., Ltd., assignee of F. J. Tarris and D. Webb, all of London, England.

389,350. **Automobile Door Latch.** Ternstedt Mfg. Co., assignee of A. A. Cripps, both of Detroit, Mich., U. S. A.

389,352. **Wiper Blade Mounting.** Trico Products Corp., assignee of W. Paulus, both of Buffalo, N. Y., U. S. A.

389,366. **Tire Chain.** O. W. Nesbitt, inventor, and T. H. Brothers, Jr., assignee of one-third of the interest, both of Chicago, Ill., U. S. A.

389,382. **Elasticized Wearing Apparel.** P. H. Boivin, Granby, P. Q.

389,416. **Motor Vehicle Wheel Suspension.** Briggs Mfg. Co., assignee of P. Klotsch, both of Detroit, Mich., U. S. A.

389,417. **Motor Vehicle Suspension.** Briggs Mfg. Co., assignee of P. Klotsch, both of Detroit, Mich., U. S. A.

389,442. **Lug Strap.** Dayton Rubber Mfg. Co., assignee of H. M. Bacon, both of Dayton, O., U. S. A.
389,446 and 389,447. **Footwear.** Dominion Rubber Co., Ltd., Montreal, assignee of F. H. Wolfhard, St. Jerome, and L. C. Woodall, Montreal, co-inventors, both in P. Q.
389,462. **Storage Battery.** Electric Storage Battery Co., Philadelphia, assignee of W. E. Kershaw, Gwynedd Valley, both in Pa., U. S. A.
389,463. **Storage Battery Retainer.** Electric Storage Battery Co., Philadelphia, assignee of W. E. Kershaw, Gwynedd Valley, both in Pa., U. S. A.
389,471. **Tubular Link Assembly.** Houde Engineering Corp., assignee of C. F. Lautz, both of Buffalo, N. Y., U. S. A.
389,515. **Vacuum Jar Cap Seal.** E. A. Keefer, assignee of I. F. Keefer, assignee of E. Wynings, guardian of the estate of R. Wynings (also known as R. W. Wynings), incompetent, all of Youngstown, O., U. S. A.
389,521. **Undergarment.** L. Levenson, Mt. Vernon, N. Y., and S. L. Berger, Newton Centre, Mass., co-inventors, both in the U. S. A.
389,535. **Mop Holder.** J. H. Flack, Verdun, P. Q.
389,537. **Stopper** for Carboys, Bottles, Etc. W. S. Freeman, Leeds, Yorkshire, England.
389,561. **Porous Rubber Cosmetic Applicator.** C. E. Zimmerman, Chicago, Ill., U. S. A.
389,602. **Stretchable Leather and Shoe.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of A. Vamos, Brooklyn, N. Y., U. S. A.
389,679. **Run-Resistant Stocking.** C. R. Hill, Toronto, Ont.
389,685. **Non-Skid Tire Device.** D. S. Kennedy, Andover, Hampshire, England.
389,691. **Vehicle Tester** Comprising Inclined Track with Surface Adapted to Grip the Tires. E. Piquerez, St. Cloud, France.
389,697. **Pipe Press.** R. Temple, Jr., Pittsburgh, Pa., U. S. A.
389,786. **Resilient Wheel.** Svenska Aktiebolaget Bromsregulator, assignee of N. G. A. Malmquist, both of Malmö, Sweden.
389,792. **Paper Carrier Sheet** for Tacky Rubber. S. D. Warren Co., Boston, Mass., assignee of G. W. Coggeshall, Yarmouth, Me., both in the U. S. A.

Germany

691,064. **Bearing Unit** with Rubber between the Metal Parts. Getefo Gesellschaft fur Technischen Fortschritt m.b.H., Berlin.
691,226. **Panties.** Deutsche Kabelwerke A.G., Berlin.
691,589. **Rubber Shaft Coupling** for Stands for Testing Airplane Motors. Deutsche Versuchsanstalt fur Luftfahrt E.V., Berlin.

United Kingdom

517,665. **Surgical Syringe.** T. D. Baxter.
517,724. **Aircraft Undercarriages** with Resilient Wheel Units. R. H. Bound.
517,842. **Dress Shield.** M. Meisl, (K. Bucher).
517,955. **Vehicle Wheels and Detachable Hub Caps Therefor.** Dunlop Rubber Co., Ltd., and G. H. Whale.
517,978. **Elastic Thread and Fabrics Embodying Such Thread.** P. E. F. Clay.
517,985. **Brake Mechanisms.** Firestone Tire & Rubber Co., Ltd.
517,986. **Load-Supporting and Shock-Absorbing Devices.** Firestone Tire & Rubber Co., Ltd.
518,060. **Resilient Surfaces for Seats, Etc.,** M. Heller.
518,141. **Inflatable Bed Mattresses.** G. MacLellan & Co., Ltd., and K. MacLellan.
518,155. **Combined Combs and Hair-Curling Appliances.** A. A. Coakley.
518,157. **Corrosion Inhibitors** for Pickling Baths. United States Rubber Co.
518,180. **De-Icer.** B. F. Goodrich Co.
518,268. **Guards for Wringers. Etc.** English Electric Co., Ltd., and A. T. Chadwick.
518,276. **Positioning of Articles on Display Cards.** T. J. Whall and John Bull Rubber Co., Ltd.
518,365. **Electric Cables.** Cablon, Ltd., and K. S. Wyatt.
518,384. **Electric Cables.** Okonite-Callender Cable Co., Inc.
519,383. **Electric Cables.** Liverpool Electric Cable Co., Ltd., R. F. D. Milner, and J. T. Frost.
519,443. **Foundation Garments.** R. & W. H. Symington & Co., Ltd., and S. Allbright.
519,492. **Tube or Tubeless Pneumatic Tires** for Vehicle Wheels. K. Hertel.
519,509. **Pneumatic Tires.** E. Witzenmann.
519,580. **Electric High-tension Cables.** Felten & Guilleaume Carlswerk Akt.-Ges.
519,602 and 519,603. **Electric Cables.** Soc. Italiana Pirelli.
519,676. **Pneumatic Tire Pressure Gages.** Kinsman, Ltd., and H. W. Chapman.
520,098. **Vehicle Wheels and Fairings.** Dunlop Rubber Co., Ltd., and C. E. Goodyear.
520,169. **Rubber Plugs or Stoppers.** Universal Rubber Paviors, Ltd., and L. Gaisman.
520,215. **Hose-Drums.** E. O. Pearce and M. Fogt.
520,222. **Load or Shock Absorber.** Firestone Tire & Rubber Co., Ltd.
520,231. **Tire Treads.** Dunlop Rubber Co., Ltd., F. G. W. King, and L. J. Lambourn.
520,245. **Electric Conductors.** British Insulated Cables, Ltd., F. J. Brislee, L. C. Bannister, L. Macfarlane, M. L. B. Gould, and L. R. B. Spence.
520,329. **Gunfire-Control Mechanisms.** India Rubber, Gutta Percha & Telegraph Works Co., Ltd., F. J. Tarris, and D. Webb.
520,340. **Flexible or Resilient Mechanical Joints.** Laycock Engineering Co., Ltd., and T. R. Charlesworth.

TRADE MARKS

United States

377,791. **Rivnuts.** Rivets. B. F. Goodrich Co., New York, N. Y.
377,792. **Cloud Bank.** Sponge rubber cushions. B. F. Goodrich Co., New York, N. Y.
377,793. **T. M. C. Footwear.** Footwear. May Department Stores Co., New York, N. Y.
377,795. Representation of a circle horizontally dissected by a line, between the words: **"ARB REX."** Golf balls. Coreless Golf Ball Co., Wilmington, Del.
377,803. **Lifetime.** Fountain pens and pencils. W. A. Scheaffer Pen Co., Fort Madison, Iowa.
377,807. **U. K. C.** Lastex swim trunks. Utica Knitting Co., Utica, N. Y.
377,808. **F Street Fashions.** Footwear. F. R. Jelleff, Inc., Washington, D. C.
377,847. The words: **"Play Master"** against background of representation of a baseball player. Game balls. J. deBeer & Son, Albany, N. Y.
377,861. **Intermezzo.** Foundation garments and garter belts. Maiden Form Brassiere Co., Inc., New York, N. Y.
377,907. **Safety-Lock.** Tires. Firestone Tire & Rubber Co., Akron, O.
377,935. **Covertex.** Prophylactic articles. Prophylactic Products Co., Inc., Boston, Mass.
377,936. **Fingertex.** Prophylactic articles. Prophylactic Products Co., Inc., Boston, Mass.
377,937. **Prophylactex.** Prophylactic articles. Prophylactic Products Co., Inc., Boston, Mass.
377,948. **Safetyfill.** Storage batteries and parts. Willard Storage Battery Co., Cleveland, O.
377,953. Representation of a circle horizontally dissected by a line, between the words: **"Arbor Wound."** Golf balls. Coreless Golf Ball Co., Wilmington, Del.
377,956. **Gabcoat.** Raincoats. Tarshes Bros., Inc., New York, N. Y.
377,962. **Hydro-Cel.** Rubber composition for sound deadening and vibration absorption. General Tire & Rubber Co., Akron, O.
377,971. **Tru-Shot.** Golf balls and clubs. Western Auto Supply Co., Kansas City, Mo.
377,982. Representation of a pair of open tongs crossed below by a six-inch rule, above which is a diamond containing the word: **"Garlock."** Sealing compound for gasket and pipe joints. Garlock Packing Co., Palmyra, N. Y.
377,983. **Garlock.** Sealing compound for gasket and pipe joints. Garlock Packing Co., Palmyra, N. Y.
378,008. **Pandora.** Footwear. Newton Elkin Shoe Co., Philadelphia, Pa.
378,013. **Value.** Dress shields. Rand Rubber Co., Brooklyn, N. Y.
378,025. **Carrie Career.** Wearing apparel. The Tailored Woman Inc., New York, N. Y.
378,027. Representation of a rectangle and the words: **"The Gale Line."** Footwear. Gale Shoe Mfg. Co., Boston, Mass.
378,041. A label containing the word: **"Dell"** below which is the letter: **"D"** in a diamond-shaped seal. Tires and tubes. Dell Tire Corp., Chicago, Ill.
378,043. **Cookie-Cutter.** Footwear. Best & Co., Inc., New York, N. Y.
378,045. **Crestaire.** Pneumatic cushions. United States Rubber Co., New York, N. Y.
378,046. **Velvite.** Grip inserts for bowling balls. Brunswick-Balke-Collender Co., Chicago, Ill.
378,047. The word: **"Websgrip"** over the background of a fanciful representation of a duck. Bowling balls. Brunswick-Balke-Collender Co., Chicago, Ill.
378,085. **Twinsulation.** Tape. United States Rubber Co., New York, N. Y.
378,102. Fanciful representation of the words: **"Smoothshoes."** Footwear. Melville Shoe Corp., New York, N. Y.
378,114. **Luggage Tone Lingerie.** Foundation garments. M. Rooney, New York, N. Y.
378,144. **Mobil.** Rubber cleaning sponges. Socony-Vacuum Oil Co., Inc., New York, N. Y.
378,160. **Campus Walkers.** Footwear Melville Shoe Corp., New York, N. Y.
378,168. **'Moistemp.'** Insulated wires and cables. Rockbestos Products Corp., New Haven, Conn.
378,189. The word: **"Firestone"** in a semi-circle, below which is the word: **"Transport."** Tires and tubes. Firestone Tire & Rubber Co., Akron, O.
378,238. **Firestone.** Bicycles and parts thereof. Firestone Tire & Rubber Co., Akron, O.
378,239. Representation of a label showing an airplane in downward flight superimposed on two circles between the words: **"Firestone Cruiser."** Bicycles and parts thereof. Firestone Tire & Rubber Co., Akron, O.
378,240. Representation of a label showing an airplane in upward flight superimposed on a circle between the words: **"Firestone Flying Ace."** Bicycles and parts thereof. Firestone Tire & Rubber Co., Akron, O.
378,241. Representation of a label showing a propellor superimposed on a wing between the words: **"Firestone Pilot."** Bicycles and parts thereof. Firestone Tire & Rubber Co., Akron, O.
378,242. Representation of a label showing an Indian archer standing above the words: **"Firestone Warrior."** Bicycles and parts thereof. Firestone Tire & Rubber Co., Akron, O.
378,246. **Kenmore Master Griptite Tires.** Pneumatic tires and inner tubes. Banner Tire Co., Boston, Mass.
378,310. Representation of a label having an oval between parallel lines, containing the words: **"Bel-Mar."** Trouser braces. Irving Brandt & Co., Chicago, Ill.
378,317. Representation of an armor headpiece attached to a shield containing the words: **"Zook Armor Treads."** Pneumatic tires. Zook Tire Co., Pueblo, Colo.
378,343. **Eskimo.** Vibrators for therapeutic uses and electric hair driers. Bersted Mfg. Co., Fostoria, O.
378,366. **Re-Ly-On.** Jar rings. Crown Cork & Seal Co., Inc., Baltimore, Md.
378,439. **Spade Grip.** Resilient vehicle tires. Firestone Tire & Rubber Co., Akron, O.
378,580. Representation of a laughing, man-like creature sitting cross-legged. Chewing gum. Frank H. Fleer Corp., Philadelphia, Pa.
378,608. **Mealorub.** Rubber powder. Centrale Vereeniging tot Beheer van Proefstations voor de Overjarige Cultures in Nedeerlandsch-Indie, Batavia, Java.
378,639. **Auburlastic.** Fabrics having interwoven elastic threads. Auburn Fabrics, Inc., New York, N. Y.
378,640. Representation of two concentric semicircles above parallel lines enclosing a circle containing the word: **"Trico."** Prophylactic sheaths. F. G. Karg, Chicago, Ill.
378,672. **Mermaid.** Dress shields. Rand Rubber Co., Brooklyn, N. Y.
378,704. **Hylastic.** Tire cord. General Tire & Rubber Co., Akron, O.
378,710. **Koro.** Prophylactic rubber goods. Holland Rantos Co., Inc., New York, N. Y.
378,721. Representation of a cut-out spool of thread above a cut-out scissors in a silhouette of a top. Clothing. Tip Top Tailors, Inc., Linden, N. J.
378,728. The letter **"V"** in a circle in a triangle. Adhesives. American Products Co., doing business as the Wisco Chemical Products Co. and Veeco Chemical Products Co., Cincinnati, O.
378,760. **Edelco.** Prophylactic rubber articles. S. H. Edelmuth, Elmhurst, N. Y.
378,782. **Insulite.** Elastic adhesive. Insulite Co., Minneapolis, Minn.
378,795. **Koroseaied.** Fabrics impregnated with synthetic rubber-like composition. B. F. Goodrich Co., New York, N. Y.
378,796. **Koroseal'd.** Fabrics impregnated with a synthetic rubber-like composition. B. F. Goodrich Co., New York, N. Y.
378,797. **Koroweb.** Open mesh fabric impregnated with synthetic rubber-like composition. B. F. Goodrich Co., New York, N. Y.
378,830. **Mikalite.** Shower curtains. I. B. Kleinert Rubber Co., New York, N. Y.
378,879. Representation of a white cross in concentric circles containing the words: **"National Hospital Association."** First aid supplies, tapes, etc. National Hospital Association, Portland, Oreg.
378,886. **Air-E-ator.** Clothing. Hyman H. Mishel, Philadelphia, Pa.
378,903. The letter: **"B"** with the word: **"Bloomingdale's"** contained in one end of the letter. Clothing. Bloomingdale Bros., Inc., New York, N. Y.
378,936. **Ogives.** Corsets. Dominion Corset Co., Ltd., Quebec, P. Q., Canada.
378,942 **De Cody.** Dress foundation garments. De Cody-Idalia Corp., Lowell, Mass.
378,946. **Pennasentic.** Footwear, clothing, etc. J. C. Penney Co., Wilmington, Del.
378,975. **Burly-flex Brogue.** Footwear. Curtis Shoe Co., Inc., Marlboro, Mass.
378,983. **Black-Out.** Coating material to protect rubber goods. R. T. Vanderbilt Co., Inc., New York, N. Y.
378,991. Representation of a box containing the word: **"SuperSaddles."** Footwear. Gale Shoe Mfg Co., Boston, Mass.
379,004. **Gold Leaf.** Rubber gloves. Armstrong Cork Co., Lancaster, Pa.
379,029. **Claw Hand.** Rubber-dipped fabric gloves. Wells-Lamont-Smith Corp., Chicago.
379,032. **Glex-Girl.** Foundation garments. Wolfe & Lang, Inc., New York, N. Y.
379,033. **Shelter Brand.** Rubber overshoes. W. T Grant Co., New York, N. Y.
379,034. **Cantando.** Corsets, girdles, etc. Maiden Form Brassiere Co., Inc., New York, N. Y.

Market Reviews

CRUDE RUBBER

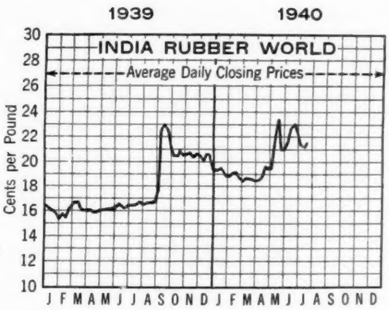
Commodity Exchange

TABULATED WEEK-END CLOSING PRICES ON THE NEW YORK MARKET

Futures	May 25	June 29	July 6	July 13	July 20
		"New" Standard			
July	.....	21.25	20.31	20.35	21.00
Aug.	.....	19.91	19.79	20.00	19.45
Sept.	.....	18.63	18.84	19.05	19.15
Dec.	.....	17.49	17.98	18.30	18.45
Mar.	.....	17.15	17.53	18.05	18.25
May	.....	17.08	17.46	18.00	18.25
June	.....	.....	17.46	18.00	18.25
		No. 1 Standard			
June	19.75	.....	.....	.....	.....
July	19.30	21.49	20.56	20.60	22.25
Aug.	.....	20.16	20.04	20.25	19.70
Sept.	18.18	18.88	19.04	19.25	19.40
Dec.	17.80	17.74	18.13	18.45	18.70
Mar.	17.50	17.30	17.68	18.20	18.45
May	.....	17.23	17.61	18.15	18.45
Volume (tons) per week					
"New" Standard	.....	50	60	30	300
No. 1 Standard	11,040	7,420	2,190	2,450	5,560

LEADING developments during July affecting the position of rubber were the formation by the R.F.C. of the Rubber Reserve Co. to purchase rubber on the open market for U. S. defense needs and the raising of the export quota for the last half of 1940. The market ruled generally firm during the month, and September futures (old contract), after closing at 19.32¢ per pound on July 1, held close to that level throughout the month to close at the slightly higher level of 19.51¢ per pound on July 25. In the table above are now shown prices for both the new and old contracts. It will be noted that trading volume during the month was relatively light, with negligible business being done in the new contract.

On July 5 the International Rubber Regulation Committee raised the export quota for the third and fourth quarters of 1940 from 80% to 85% of basic quotas. The increase, aimed at facilitating the purchase of 150,000 tons of crude rubber by the Rubber Reserve Co., was generally less than anticipated in trade circles here. At 85%, permissible shipments for the period would amount to 114,123 tons monthly. This together with an estimated 3,500 tons monthly from non-agreement territories would make a total of 117,622 tons per month. A study by the Commodity Exchange, Inc., which takes into consideration overshipments of 5% of the yearly permissible amounts that are allowed by the scheme, arrives at a figure of 1,004,385 tons as the maximum expected shipments during the last eight months of 1940. This gives a monthly average of 125,548 tons. World absorption for May, the latest figure available, was 96,922 tons. On the basis of this figure and the Commodity Exchange estimate, the excess of maximum shipments over absorption, amounts to 28,626 tons monthly or 229,008 tons for the eight months, May through December. In the world absorption figures for May were included 21,000 tons shipped to continental Europe. It is believed that since then, with the extension of the British blockade, this figure has been curtailed sharply. This together with lower U. S. consumption should give 1940 export excess, after May 1, sufficient to care for purchases by the Rubber Reserve Co. and barter rubber, which together total 235,000 tons approximately.



New York Outside Market—Spot Ribbed Smoked Sheets

Crude rubber consumption in the United States, which showed a sharp seasonal decline in June to 46,506 long tons, will probably show a further drop for July and August. Although consumption should increase again in the early fall, it is doubtful that the last six months of 1940 will be so high as the first half.

New York Outside Market

Activity in the outside market was reported somewhat more active during July. Shipment offerings from the Far East were scarce; and factory demand, although fairly active, was limited chiefly to small quantities. The price of No. 1 ribbed smoked sheets, which closed at 22¢ per pound on July 1, held generally steady throughout the month and closed at this same level on July 25.

The week-end closing prices on No. 1 ribbed smoked sheets follow: June 29, 21½¢; July 6, 21¢; July 13, 21⅛¢; and July 20, 22¢.

New York Quotations

New York outside market rubber quotations in cents per pound

	July 26, 1939	June 26, 1940	July 29, 1940
Plantations			
Rubber latex *gal.*	61/62	84/85	77/80
Paras			
Upriver fine......	14¼	20¼	18¼
Upriver fine......	*16¾	*22½	*20½
Upriver coarse....	10	12	11¼
Upriver coarse....	*15¼	*19	*18½
Islands fine.......	14½	18	18
Islands fine.......	*17	*22	*20
Acre, Bolivian fine	14½	20½	18½
Acre, Bolivian fine	*17	*23	*21
Beni, Bolivian fine	15	21	19¾
Madeira fine	14½	20¼	18¼
Caucho			
Upper ball........	10	12	11¼
Upper ball........	*15¼	*19	*18½
Lower ball.......	9¾	11½	11
Pontianak			
Pressed block.....	9/16	17½/20	20½/25
Guayule			
Ampar	13¼	15	15
Africans			
Rio Nuñez........	15⅛	18½	18½
Black Kassai.....	15⅛	18½	18½
Prime Niger flake.	25	22½	22½
Gutta Percha			
Gutta Siak	9½	21/22½	23
Gutta Soh........	14¾	30	29
Red Macassar....	90/1.20	1.20	1.20
Balata			
Block Ciudad Bolivar	..	..	..
Manaos block.....	30	..	56
Surinam sheets...	42	..	62
Amber	44	..	68

* Washed and dried crepe. Shipments from Brazil.

Mexican Rubber Imports

Imports of crude rubber into Mexico rose from 2,923 long tons in 1938 to 5,101 long tons in 1939. These imports were especially large in the second half of 1939: 3,195 tons, against 1,906 tons in the first half of the year. Mexico also imported 75 tons of liquid latex in 1939, against 30 tons in 1938.

New York Outside Market—Spot Closing Prices—Plantation Grades—Cents per Pound

	June, 1940						July, 1940			
	24	25	26	27	28	29	1	2	3	4†
No. 1 Ribbed Smoked Sheet.	23	22¼	22¼	22¼	21⅜	21½	22	21½	21	..
No. 1 Thin Latex Crepe.....	23	22¼	22¼	22¼	21⅜	21½	22	21½	21	..
No. 2 Thick Latex Crepe....	23	22¼	22¼	22¼	21⅜	21½	22	21½	21	..
No. 1 Brown Crepe........	21¾	21	21	21	20⅛	20¼	20¾	20¼	19¾	..
No. 2 Brown Crepe........	21½	20¾	20¾	20¾	19⅞	20	20½	20	19½	..
No. 2 Amber..............	21¾	21	21	21	20⅛	20¼	20¾	20¼	19¾	..
No. 3 Amber..............	21½	20¾	20¾	20¾	19⅞	20	20½	20	19½	..
Rolled Brown..............	18½	17¾	17¾	17¾	16⅞	17	17½	17	16½	..

	July, 1940													
	5	6	8	9	10	11	12	13*	15	16	17	18	19	20*
No. 1 Ribbed Smoked Sheet.	21	21	21⅛	21⅛	21	21	21⅛	..	21	21¼	21⅞	22	22	..
No. 1 Thin Latex Crepe.....	21	21	21⅛	21⅛	21	21	21⅛	..	21	21¼	21⅞	22	22	..
No. 2 Thick Latex Crepe....	21	21	21⅛	21⅛	21	21	21⅛	..	21	21¼	21⅞	22	22	..
No. 1 Brown Crepe........	19¾	19¾	19⅞	19⅞	19¾	19¾	19⅞	..	19¾	20	20⅝	20¾	20¾	..
No. 2 Brown Crepe........	19½	19½	19⅝	19⅝	19½	19½	19⅝	..	19½	19¾	20⅜	20½	20½	..
No. 2 Amber..............	19¾	19¾	19⅞	19⅞	19¾	19¾	19⅞	..	19¾	20	20⅝	20¾	20¾	..
No. 3 Amber..............	19½	19½	19⅝	19⅝	19½	19½	19⅝	..	19½	19¾	20⅜	20½	20½	..
Rolled Brown..............	16½	16½	16⅝	16⅝	16½	16½	16⅝	..	16½	16¾	17⅜	17½	17½	..

*Closed. †Holiday.

IMPORTS, CONSUMPTION, AND STOCKS

United States and World Statistics of Rubber Imports, Exports, Consumption, and Stocks—Long Tons

Twelve Months	U.S. Imports*	U.S. Consumption¶	U.S. Stocks Mfrs., Dealers, Importers, Etc.†¶	U.S. Stocks Afloat	U.K.—Public Warehouses, London, Liverpool†‡	Singapore and Penang Dealers and Port Stocks†‡	World Production (Net Exports)‡	World Consumption Estimated‡	World Stocks†‡§
1937	584,851	543,600	262,204	63,099	57,785	44,792	1,139,800	1,105,002	646,252
1938	400,178	437,031	231,500	45,105	86,853	27,084	894,900	942,252	596,498
1939	499,473	592,000	125,800	91,095	44,917a	15,299	1,004,019	1,103,692	447,666a
1940									
Jan.	72,496	54,978	142,368b	90,285b	.....	35,928	108,710	98,049	....
Feb.	43,088	49,832	134,328b	112,257b	.....	33,563	113,991	95,247	....
Mar.	59,258	50,192	142,414b	113,619b	.....	23,830	112,384	90,454	....
Apr.	70,699	50,103	162,459b	102,557b	.....	42,239	88,814	98,697	....
May	51,431	51,619	161,446b	109,364b	......	32,770	122,210	97,967	....
June	53,889	46,506	168,235b	119,138b	.....	....	....	....	....

*Including liquid latex. †Stocks on hand the last of the month or year. ‡*Statistical Bulletin of the International Rubber Regulation Committee.* §Stocks at U. S. A., U. K., Singapore and Penang, Para, Manaos, regulated areas, and afloat. ¶Corrected to 100% from estimate of reported coverage. *a.* Stocks as of Aug. 31, 1939. *b.* Includes government barter rubber.

THE R.M.A. estimates United States rubber manufacturers consumed 46,506 long tons of crude rubber during June, 9.9% under the May consumption of 51,619 long tons and 4% below June, 1939, when 48,438 (revised) long tons were consumed.

Gross imports for June, as reported by the Department of Commerce, were 53,889 long tons, 4.8% over the May figure of 51,431 long tons and 56.8% over the 34,363 long tons imported in June, 1939.

Total domestic stocks, estimated by the R. M. A., at the end of June were 168,235 long tons, 4.2% over the 161,446 long tons on hand May 31, but 3% under the 173,493 (revised) long tons on hand June 30, 1939.

Crude rubber afloat to U. S. ports on June 30 is estimated at 119,138 long tons, against 109,364 long tons reported afloat on May 31 and 51,274 long tons afloat June 30, 1939.

The figure for U. S. Stocks on June 30 includes 28,365 long tons of government emergency rubber. The amount afloat is not available for publication.

RECLAIMED RUBBER

ACCORDING to R. M. A. figures, June reclaimed rubber consumption is estimated at 15,844 long tons, 0.8% above that of May; production, 16,631 long tons; and stocks on hand June 30, 28,327 long tons. It is significant that while crude rubber consumption showed a decline of 9.9% from May to June, reclaim consumption increased slightly. This gain was an indication of the increased activity in those lines consuming relatively larger quantities of reclaim. The insulated wire, footwear, and mechanical goods industries continue to be active consumers of reclaim. However the consumption during July will probably be lower than that of June.

The market is steady and all grades of reclaim continue at last month's levels.

New York Quotations

July 25, 1940

	Sp. Grav.	¢ per lb.
Auto Tire		
Black Select	1.16-1.18	6 / 6¼
Acid	1.18-1.22	7 / 7¼
Shoe		
Standard	1.56-1.60	6½/ 6¾
Tubes		
Red Tube	1.15-1.30	9 / 9¼
Compound	1.10-1.20	9 /10
Miscellaneous		
Mechanical Blends ...	1.25-1.50	4½/ 5
White	1.35-1.50	12½/14

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

United States Reclaimed Rubber Statistics—Long Tons

Year	Production†	Consumption†	Consumption % of Crude	U. S. Stocks*†	Exports
1938	122,403	120,800	27.6	23,000	7,403
1939	186,000	170,000	28.7	25,250	12,611
1940					
Jan.	19,297	16,070	29.2	27,418	1,059
Feb.	17,992	15,370	30.8	28,602	1,436
Mar.	17,234	15,931	31.7	28,488	1,420
Apr.	16,568	16,298	32.5	27,558	977
May	17,552	15,719	30.5	28,397	866
June	16,631	15,844	34.1	28,327	....

*Stocks on hand the last of the month or year. †Corrected to 100% from estimate of reported coverage. *Compiled by The Rubber Manufacturers Association, Inc.*

RUBBER SCRAP

THE demand for scrap rubber continued good during July, with reclaimed rubber production maintaining a high level of activity. The market is steady, and all grades of scrap remain unchanged at last month's quotations except black auto peelings, which jumped from $26-$27 per ton to $36-$37.

Consumers' Buying Prices

(Carlot Lots for July 25, 1940)

		Prices
Boots and Shoes		
Boots and shoes, black....	*lb.*	$0.01⅛/$0.01¼
Colored	*lb.*	.00⅞/ .01
Untrimmed arctics	*lb.*	.00⅞/ .01
Inner Tubes		
No. 1, floating............	*lb.*	.10 / .10½
No. 2, compound..........	*lb.*	.04⅝/ .04⅞
Red	*lb.*	.04½/ .04¾
Mixed tubes	*lb.*	.03⅞/ .04¼
Tires (Akron District)		
Pneumatic Standard		
Mixed auto tires with beads	*ton*	14.50 /15.50
Beadless	*ton*	18.00 /18.50
Auto tire carcass.......	*ton*	30.00 /35.00
Black auto peelings.....	*ton*	36.00 /37.00
Solid		
Clean mixed truck......	*ton*	34.00 /35.00
Light gravity	*ton*	42.00 /44.00
Mechanicals		
Mixed black scrap........	*ton*	22.00 /24.00
Hose, air brake...........	*ton*	20.00 /22.50
Garden, rubber covered.	*ton*	12.50 /14.00
Steam and water, soft...	*ton*	12.50 /14.00
No. 1 red	*lb.*	.03 / .03¼
No. 2 red	*lb.*	.02¼/ .02½
White druggists' sundries..	*lb.*	.03¾/ .04
Mixed mechanicals	*lb.*	.02¼/ .02½
White mechanicals........	*lb.*	.03⅝/ .03¾
Hard Rubber		
No. 1 hard rubber........	*lb.*	.11½/ .13

THAILAND

Recent figures regarding Thailand's foreign trade in rubber are particularly interesting on two counts. First, United States exports to this country in March, 1940, included 500,000 pounds of scrap rubber. Thailand never before was a market for scrap rubber and, as far as is known, has no means of utilizing it, especially in such quantity. Second, the drop in raw rubber exports from Thailand in the last quarter of 1939 was abnormal. The 4,652 tons for that period is by far the lowest for any quarter in the four years from 1936 to 1939, inclusive, and represents only 8.9% of the total of 41,266 tons shipped in 1939. In the last quarter of 1938, exports were 11,228 tons, or 27% of the total for the year, and in the three years 1936-1938 the average for the final quarter worked out at 24.75% of the annual total. Shipments in the first nine months of 1939 were at the rate of 48,600 tons for the year. But, as Thailand's limit for 1939 was 41,000 tons, the shipments of the last quarter were only what could have been expected unless an excess were to be shown.

According to the International Rubber Regulation Committee's bulletin, exports from Thailand were 13,140 long tons in the first quarter of 1940 against 13,925 in the first quarter of 1939.

COMPOUNDING INGREDIENTS

DEMAND for compounding ingredients by the rubber industry during July was fairly well maintained for this season of the year. Some decline in activity was reported as a result of inventory and vacation shut-downs during the early part of the month. The outlook at present points toward an early fall pick-up in business and steadily increasing activity during the remainder of the year. Prices in general are unchanged.

CARBON BLACK. The heavy demand for black during the latter part of June fell off measurably after July 1 when the price advance, announced here last month, became effective. With a moderate movement this month, producers' stocks were expected to show a gain for July. The heavy sales in June resulted in a decline in stocks of about 17,700,000 pounds.

According to the U. S. Bureau of Mines, sales of carbon black in 1939 rose to an all-time record of 560,533,000 pounds; domestic sales increased 46.5% to 356,705,000 pounds, and exports amounted to 203,828,000 pounds. Of the domestic sales, 89% went to rubber companies, 6% to ink companies, 2% to paint companies, and 3% to miscellaneous users. Production of 525,166,000 pounds also set an all-time record. More than 86% of this came from Texas; other producing states were Kansas, Louisiana, and Oklahoma. It was estimated that 347,270,000,000 cubic feet of natural gas were used to manufacture last year's production of carbon black. The yield increased to 1.51 pounds per thousand cubic feet of gas.

FACTICE OR RUBBER SUBSTITUTE. Good demand was reported, with prices reduced on some grades.

LITHARGE. The demand was fair, and prices firm.

LITHOPONE. Good sales volume held throughout the month, and the price is unchanged.

RUBBER CHEMICALS. The demand for these materials continued at a high level and above the corresponding period last year. Prices in general are unchanged.

RUBBER SOLVENTS. The demand was reported to be less active, with tire makers buying for immediate needs only. The price is steady.

TITANIUM PIGMENTS. The demand for these pigments in the rubber industry continues to be rather good, and sales in July were running ahead of those in June. An increased demand for use of titanium pigments in the manufacture of white sidewall tires has been noted. Prices are steady and unchanged.

ZINC OXIDE. The demand was generally active, although some slackening was noted the first week of July. There are no changes in price.

Current Quotations*

Abrasives

Pumicestone, powdered	*lb.*	$0.03 / $.035
Rottenstone, domestic	*lb.*	.03 / .035
Silica, 15	*ton*	

Accelerators, Inorganic

Lime, hydrated, *l.c.l.*, New York	*ton*	20.00
Litharge (commercial)	*lb.*	.075

Accelerators, Organic

A-1	*lb.*	.24 / .30
A-10	*lb.*	.31 / .35
A-11	*lb.*	.52 / .65
A-19	*lb.*	.52 / .65
A-32	*lb.*	.70 / .80
A-77	*lb.*	.42 / .55
A-100	*lb.*	.42 / .55
Accelerator 49	*lb.*	.40 / .42
737	*lb.*	.42 / .43
737-50	*lb.*	.25 / .26
808	*lb.*	.70 / .72
833	*lb.*	1.15
Acrin	*lb.*	.60
Aldehyde ammonia	*lb.*	.65 / .70
Altax	*lb.*	.55 / .60
B-J-F	*lb.*	.50 / .55
Beutene	*lb.*	.70 / .75
Butyl Eight	*lb.*	.98 / 1.00
Zimate	*lb.*	2.50
C-P-B	*lb.*	2.00
Captax	*lb.*	.50 / .55
Crylene	*lb.*	.40 / .47
Paste	*lb.*	.30 / .36
D-B-A	*lb.*	2.00
Delac A	*lb.*	.40 / .50
O	*lb.*	.40 / .50
P	*lb.*	.40 / .50
Di-Esterex-N	*lb.*	.60 / .70
DOTG (Di-ortho-tolyguanidine)	*lb.*	.44 / .46
DPG (Diphenylguanidine)	*lb.*	.35 / .36
El-Sixty	*lb.*	$0.50 /$0.65
Ethylideneaniline	*lb.*	.42 / .43
Ethyl Zimate	*lb.*	2.50
Formaldehyde P.A.C.	*lb.*	.0625
Formaldehydeaniline	*lb.*	.31
Formaldehyde-para-toluidine	*lb.*	.52 / .54
Guantal	*lb.*	.40 / .50
Hepteen	*lb.*	.35 / .40
Base	*lb.*	1.35 / 1.50
Hexamethylenetetramine U.S.P.	*lb.*	.33
Technical	*lb.*	.33
Lead oleate, No. 999	*lb.*	.13
Witco	*lb.*	.15
Ledate	*lb.*	2.35
Monex	*lb.*	2.35
Novex	*lb.*	
O-N-V	*lb.*	1.00 / 1.10
O-X-A-F	*lb.*	.50 / .55
Ovac	*lb.*	.50 / .55
Para-nitroso-dimethylaniline	*lb.*	.85
Pentex	*lb.*	1.00 / 1.10
Flour	*lb.*	.15 / .16
Phenex	*lb.*	.50 / .55
Pip-Pip	*lb.*	2.50
Pipsolene	*lb.*	1.55 / 1.85
R-2	*lb.*	1.40 / 1.80
R-23	*lb.*	.40
R & H 50-D	*lb.*	.42 / .43
Rotax	*lb.*	.60 / .65
Safex	*lb.*	1.20 / 1.30
Santocure	*lb.*	.80 / 1.00
Selenac	*lb.*	2.75
SPDX	*lb.*	.70 / .75
A	*lb.*	.70 / .75
Super-sulphur No. 1	*lb.*	.50
2	*lb.*	.18 / .20
Tetrone A	*lb.*	2.70
Thiocarbanilide	*lb.*	.24 / .30
Thionex	*lb.*	2.35
Thiurad	*lb.*	2.35
Trimene	*lb.*	.55 / .65
Base	*lb.*	1.05 / 1.20
Triphenylguanidine (TPG)	*lb.*	.45
Tuads	*lb.*	2.35
Ulto	*lb.*	1.25 / 1.75
Ureka	*lb.*	.60 / .75
Blend B	*lb.*	.60 / .75
C	*lb.*	.56 / .65
Vulcanex	*lb.*	.42 / .43
Vulcanol	*lb.*	.85
Z-B-X	*lb.*	2.50
Zenite	*lb.*	.46 / .48
A	*lb.*	.53 / .55
B	*lb.*	.46 / .48
Zimate	*lb.*	$2.35

*Prices in general are f.o.b. works. Range indicates grade or quantity variations. Space limitation prevents listing all known ingredients. Requests for information not recorded will receive prompt attention.

Activators

Aero Ac 50	*lb.*	.46 /$0.56
Barak	*lb.*	.50
MODX	*lb.*	.30 / .35
SL No. 10	*lb.*	.11 / .14

Age Resisters

AgeRite Alba	*lb.*	1.50 / 1.65
Exel	*lb.*	1.00 / 1.02
Gel	*lb.*	.57 / .59
Hipar	*lb.*	.65 / .67
Powder	*lb.*	.52 / .54
AgeRite Resin	*lb.*	.52 / .54
D	*lb.*	.52 / .54
White	*lb.*	1.25 / 1.40
Akroflex C	*lb.*	.56 / .58
Albasan	*lb.*	.70 / .75
Aminox	*lb.*	.52 / .61
Antox	*lb.*	.56
B-L-E	*lb.*	.52 / .61
Powder	*lb.*	.65 / .74
B-X-A	*lb.*	.52 / .61
Copper Inhibitor X-872-A	*lb.*	1.15
Flectol B	*lb.*	.52 / .65
H	*lb.*	.52 / .65
White	*lb.*	.90 / 1.15
M-U-F	*lb.*	1.50
Neozone (standard)	*lb.*	.63
A	*lb.*	.52 / .54
B	*lb.*	.63
C	*lb.*	.52 / .54
D	*lb.*	.52 / .54
E	*lb.*	.63
Oxynone	*lb.*	.64 / .80
Parazone	*lb.*	.68
Permalux	*lb.*	1.20
Santoflex B	*lb.*	.52 / .65
Solux	*lb.*	1.30
Stabilite	*lb.*	.52 / .54
Alba	*lb.*	.70 / .75
Thermoflex A	*lb.*	.65 / .67
Tysonite	*lb.*	.16
V-G-B	*lb.*	.52 / .61

Alkalies

Caustic soda, flake, Columbia (400-*lb. drums*)	100 *lbs.*	2.70 / 3.55
liquid, 50%	100 *lbs.*	1.95
solid (700-*lb. drums*)	100 *lbs.*	2.30 / 3.15

Antiscorch Materials

A-F-B	*lb.*	.35 / .40
Antiscorch T	*lb.*	.90
Cumar RH	*lb.*	.10
E-S-E-N	*lb.*	.35 / .40
R-17 Resin (*drums*)	*lb.*	.10
RM	*lb.*	1.25
Retarder W	*lb.*	.36
Retardex	*lb.*	.45 / .48
U-T-B	*lb.*	.35 / .40

Antisun Materials

Heliozone	*lb.*	.22 / .23
S.C.R.	*lb.*	.33 / .35
Sunproof	*lb.*	.22 / .27

Brake Lining Saturant

B.R.T. No. 3	*lb.*	.0165/ .0175

Colors

Black		
Du Pont powder	*lb.*	.42 / .44
Lampblack (commercial), *l.c.l.*	*lb.*	.15
Blue		
Brilliant	*lb.*	
Du Pont dispersed	*lb.*	.83 / 3.95
Powders	*lb.*	2.25 / 3.75
Toners	*lb.*	.08 / 3.85
Brown		
Mapico	*lb.*	.11
Green		
Brilliant	*lb.*	
Chrome, light	*lb.*	
medium	*lb.*	.22
oxide (*freight allowed*)	*lb.*	
Dark	*lb.*	
Du Pont dispersed	*lb.*	.98 / 1.75
Powders	*lb.*	1.00 / 5.50
Guignet's (*bbls.*)	*lb.*	.70
Light	*lb.*	
Toners	*lb.*	.85 / 3.75
Orange		
Du Pont dispersed	*lb.*	.88 / .98
Powders	*lb.*	.88 / 2.75
Lake	*lb.*	
Toners	*lb.*	.40 / 1.60
Orchid		
Toners	*lb.*	1.50 / 2.00
Pink		
Toners	*lb.*	1.50 / 2.00
Purple		
Permanent	*lb.*	
Toners	*lb.*	.60 / 2.10

Red

Antimony		
Crimson, 15/17%	lb.	
R. M. P. No. 3	lb.	$0.48
Sulphur free	lb.	
R.M.P.	lb.	.52
Golden 15/17%	lb.	
7-A	lb.	.37
Z-2	lb.	.23
Cadmium, light (400-*lb.* *bbls.*)	lb.	.75 /$0.80
Chinese	lb.	
Crimson	lb.	
Du Pont dispersed	lb.	.93 / 2.05
Powders	lb.	.285 / .90
Mapico	lb.	.0925
Medium	lb.	
Rub-Er-Red (*bbls.*)	lb.	.0925
Scarlet	lb.	.08 / 2.00
Toners	lb.	.08 / 2.00

White

Lithopone (*bags*)	lb.	.0360/ .0385
Albalith	lb.	.0360/ .0385
Astrolith (50-*lb.* *bags*)	lb.	.0360/ .0385
Azolith	lb.	.0360/ .0385
Cryptone-BA-19	lb.	.05 / .0525
BT	lb.	.05 / .0525
CB	lb.	.05 / .0525
ZS No. 20	lb.	.075 / .0775
86	lb.	.075 / .0775
230	lb.	.075 / .0775
800	lb.	
Sunolith	lb.	.0360/ .0385
Ray-Bar	lb.	.0525/ .0575
Ray-Cal	lb.	.05 / .0525
Rayox	lb.	.13
Titanolith (50-*lb.* *bags*)	lb.	.05 / .0525
Titanox-A (50-*lb.* *bags*)	lb.	.13 / 1375
B (50-*lb.* *bags*)	lb.	.0525/ .0550
30 (50-*lb.* *bags*)	lb.	.0525/ .0550
C (50-*lb.* *bags*)	lb.	.05 / .0525
M (50-*lb.* *bags*)	lb.	.0525/ .0550
Ti-Tone	lb.	
Zinc Oxide		
Azo ZZZ-11	lb.	.0625/ .0650
44	lb.	.0625/ .0650
55	lb.	.0625/ .0650
66	lb.	.0625/ .0650
French Process, Florence		
Green Seal-8	lb.	.08 / .0825
Red Seal-9	lb.	.075 / .0775
White Seal-7	lb.	.085 / .0875
Kadox, Black Label-15	lb.	.065 / .0675
No. 25	lb.	.075 / .0775
Red Label-17	lb.	.065 / .0675
Horse Head Special 3	lb.	.0625/ .065
XX Red-4	lb.	.0625/ .065
23	lb.	.0625/ .065
72	lb.	.0625/ .065
78	lb.	.0625/ .065
80	lb.	.0625/ .065
103	lb.	.0625/ .065
110	lb.	.0625/ .065
St. Joe (lead free)		
Black Label	lb.	.0625/ .065
Green Label	lb.	.0625/ .065
Red Label	lb.	.0625/ .065
U.S.P.	lb.	.095 / .0975
White Jack	lb.	.075 / .0775
Zopaque (50-*lb.* *bags*)	lb.	.13 / .1375

Yellow

Cadmolith (cadmium yellow), (400-*lb.* *bbls.*)	lb.	.50 / .55
Du Pont dispersed	lb.	1.25 / 1.75
Powders	lb.	.135 / 2.75
Lemon	lb.	
Mapico	lb.	.0675
Toners	lb.	2.50

Dispersing Agents

Bardex	lb.	.0395/ .042
Bardol	lb.	.0225/ .045
Darvan	lb.	.30 / .39
Nevoll (*drums, c.l.*)	lb.	.0225
Santomerse S	lb.	.11 / .25

Fillers, Inert

Asbestine, *c.l.*	ton	15.00
Barytes	ton	30.00 /36.00
f.o.b., St. Louis (50-*lb.* *paper bags*)	ton	22.85
off color, domestic	ton	21.50 /26.50
white, imported	ton	
Blanc fixe, dry, precip.	lb.	.03 / .035
Calcene	ton	37.50 /43.00
Infusorial earth	lb.	.025 / .03
Kalite No. 1	ton	24.00 /30.00
3	ton	34.00 /40.00
Kalvan	ton	121.00
Magnesia, calcined, heavy	lb.	.04
Carbonate, *l.c.l.*	lb.	.0725/ .095
Paradene No. 2 (*drums*)	lb.	.045
Pyrax A	ton	6.00 /20.00
Whiting		
Columbia Filler	ton	9.00 /14.00
Suprex, white extra light	ton	45.00
heavy	ton	45.00
Witco, *c.l.*	ton	6.00

Finishes

Rubber lacquer, clear	gal.	
colored	gal.	
Starch, corn, pwd.	100 lbs.	
potato	lb.	
Talc	ton	$0.025 /$0.035

Flock

Cotton flock, dark	lb.	.09 / .11
dyed	lb.	.40 / .80
white	lb.	.11 / .20
Rayon flock, colored	lb.	.75 / 2.00
white	lb.	.75 / 1.00

Latex Compounding Ingredients

Accelerator 85	lb.	.35
89	lb.	1.40
122	lb.	1.55
552	lb.	2.50
Aerosol OT Aqueous 10%	lb.	.15 / .175
Antox, dispersed	lb.	.42
Aquarex A	lb.	.35
D	lb.	.75
F	lb.	.85
WA Paste	lb.	.28
Areskap No. 50	lb.	.18 / .24
100, dry	lb.	.39 / .51
Aresket No. 240	lb.	.16 / .22
300, dry	lb.	.42 / .50
Aresklene No. 375	lb.	.35 / .50
400, dry	lb.	.51 / .65
Black No. 25, dispersed	lb.	.22 / .40
Collocarb	lb.	.07
Color Pastes, dispersed	lb.	.35 / 1.90
Compound G-11 NW	lb.	
Dispersex No. 15	lb.	.11 / .12
No. 20	lb.	.08 / .10
Emo, brown	lb.	
white	lb.	
Factice Compound, dispersed	lb.	
Heliozone, dispersed	lb.	.25
Igepon A	lb.	
Latac	lb.	
MICRONEX, Colloidal	lb.	.055 / .0655
Nekal BX (dry)	lb.	
Pipsol X	lb.	3.05 / 3.55
R-2 Crystals	lb.	2.50 / 2.75
R-23	lb.	.40
RN-2	lb.	2.00 / 2.25
Crystals	lb.	2.00 / 2.25
S-1 (400-*lb.* *drums*)	lb.	.65
Santobrite Briquettes	lb.	.17 / .26
Powder	lb.	.16 / .26
Santomerse D	lb.	.41 / .65
S	lb.	.11 / .25
No. 1	lb.	.18 / .35
No. 2	lb.	.18 / .35
No. 3	lb.	.40 / .65
No. 3P	lb.	.29 / .45
Santovar A	lb.	1.15 / 1.40
Stablex A	lb.	.90 / 1.10
B	lb.	.65 / .90
C	lb.	.40 / .50
Sulphur, dispersed	lb.	.10 / .15
No. 2	lb.	.075
T-1 (400-*lb.* *drums*)	lb.	.40
Tepidone	lb.	1.20
Vulcan Colors	lb.	
Zinc oxide, dispersed	lb.	.12 / .15

Mineral Rubber

Black Diamond	ton	25.00
B.R.C. No. 20	lb.	.009 / .01
Hydrocarbon, hard	ton	23.00
Genasco Hydrocarbon, granulated	ton	
solid	ton	
Gilsonite	ton	
Parmr	ton	
Pioneer	ton	
285°-300°	ton	23.00 /42.00

Mold Lubricants

Lubrex	lb.	.25 / .30
Mold Paste	lb.	.12 / .18
Sericite	ton	65.00 /75.00
Soapbark	lb.	
Soapstone, *l.c.l.*	ton	25.00 /35.00

Oil Resistant

AXF	lb.	.40 / .50

Reclaiming Oils

B.R.V.	lb.	.032 / .0345
No. 1621	lb.	.019 / .02
S.R.O.	lb.	.019 / .02
X-159	gal.	.20

Reenforcers

Carbon Black		
Aerfloted Arrow Specification (*bags only*)	lb.	.02925†
Arrow Compact Granulized	lb.	.02925†
Certified Heavy Compressed (*bags only*)	lb.	.02925†
Spheron	lb.	.02925†
Continental, dustless	lb.	.02925†
Compressed (*bags only*)	lb.	.02925†
Disperso	lb.	.02925†
Dixie	lb.	.02925†
Dixiedensed	lb.	.02925†
66	lb.	.02925†
Excello, dustless	lb.	$0.02925†
Fumonex	lb.	.03
Gastex	lb.	.03 /$0.07
Kosmobile	lb.	.02925†
66	lb.	.02925†
Kosmos	lb.	.02925†
MICRONEX Beads	lb.	.02925†
Mark II	lb.	.02925†
Standard	lb.	.02925†
W-5	lb.	.02925†
W-6	lb.	.02925†
P-33	lb.	.0475 / .0725
Pelletex	lb.	.03 / .07
Supreme, dustless	lb.	.02925†
Thermax	lb.	.02 / .0475
Velvetex	lb.	.022 / .035
"WYEX BLACK"	lb.	.02925†
Carbonex	lb.	.029 / .034
S	lb.	.03 / .0350
Clays		
Aerfloted Paragon (50-*lb.* *bags*)	ton	10.00
Suprex (50-*lb.* *bags*)	ton	10.00
Barden	ton	10.00
Catalpo, *c.l.*	ton	30.00
Chicora	ton	10.00
China	ton	
Crown	ton	10.00
Dixie	ton	10.00 /22.50
Hi-White	ton	10.00
Langford	ton	8.50
NcNamee	ton	10.00 /22.50
Par	ton	10.00
Paraforce, *c.l.*	ton	40.00
Witco, *c.l.*	ton	10.00
Cumar EX	lb.	.045
MH	lb.	.065 / .11
V	lb.	.09 / .12
Silene	lb.	.04 / .045

†Price quoted is f.o.b. works (bags). The price f.o.b. works (bulk) is 2.75¢ per pound; f.o.b. Hoboken (bulk), 3.63¢; f.o.b. No. Atlantic Docks (bags), 3.80¢. All prices are carlot.

Reodorants

Amora A	lb.	
B	lb.	
C	lb.	
D	lb.	
Compound G-4	lb.	
G-11	lb.	
Curodex 19	lb.	2.75
188	lb.	3.50
Para-Dors	lb.	4.50
Rodo No. 0	lb.	3.50 / 4.00
10	lb.	4.50 / 5.00
198	lb.	

Rubber Substitutes

Black	lb.	.08 / .12
Brown	lb.	.08 / .115
White	lb.	.085 / .135
Factice		
Amberex	lb.	.25
Type B	lb.	.1875
Brown	lb.	.08 / .12
Fac-Cel B	lb.	.13
C	lb.	.13
Neophax A	lb.	.09
B	lb.	.089
White	lb.	.08 / .12

Softeners

B.R.T. No. 7	lb.	.0165/ .0175
Bondogen	lb.	.98 / 1.25
Burgundy pitch	lb.	.06
Cycline oil	gal.	.14 / .20
Dispersing Oil No. 10	lb.	.0335/ .036
Nuba resinous pitch (*drums*) Grades No. 1 and No. 2	lb.	.0265
Nubalene Resin	lb.	.025
Palm oil (Witco), *c.l.*	lb.	
Palmol	lb.	
Para Flux	gal.	.085 / .18
No. 2016	gal.	.15 / .20
Para Lube	lb	.425 / .48
Pine tar	gal.	
Plastogen	lb.	.0775/ .10
Plastone	lb.	.27 / .30
R-19 Resin (*drums*)	lb.	.10
21 Resin (*drums*)	lb.	.10
Reogen	lb.	.115 / .22
Rosin oil, compounded	gal.	.40
RPA No. 1	lb.	.65
2	lb.	.65
3	lb.	.46
Rubtack	lb.	.10
Tackol	lb.	.085 / .18
Tonox	lb.	.52 / .61
Tonox D	lb.	.75 / .85
Witco No. 20, *l.c.l.*	gal.	.20
X-1 resinous oil (*tank car*)	lb.	.01

Softeners for Hard Rubber Compounding

Resin C. Pitch 45°C. M.P.	lb.	.013 / .014
60°C. M.P.	lb.	.013 / .014
75°C. M.P.	lb.	.013 / .014

Solvents

Beta-Trichlorethane	gal.	
Carbon bisulphide	lb.	
tetrachloride	lb.	
Cosol No. 1	gal.	.25 / .30
No. 2	gal.	.20 / .28
No. 3	gal.	.20 / .28
Industrial 90% benzol (*tank car*)	gal.	.15
Skellysolve	gal.	

(*Continued on page* 88)

COTTON AND FABRICS

New York Cotton Exchange Week-End Closing Prices

Futures	May 25	June 29	July 6	July 13	July 20
June	9.82	.....	.....	.....	.....
July	9.67	10.42	10.04	10.04	.....
Aug.	.....	10.17	9.89	9.79	9.45
Sept.	9.13	9.19	9.45	9.43	9.30
Dec.	8.70	9.04	9.32	9.30	9.16
Mar.	8.51	8.77	9.07	9.09	8.94
May	.....	8.61	8.90	8.91	8.77
July	.....	.....	.....	.....	8.61

New York Quotations

July 26, 1940

Drills	
38-inch 2.00-yard ... yd.	$0.11⅜
40-inch 3.47-yard	.06½
50-inch 1.52-yard	.15⅜
52-inch 1.85-yard	.12⅝
52-inch 1.90-yard	.12⅝
52-inch 2.20-yard	.11¼
52-inch 2.50-yard	.09⅞
59-inch 1.85-yard	.13
Ducks	
38-inch 2.00-yard D. F. ... yd.	.11/.12½
40-inch 1.45-yard S. F.	.15½
51½-inch 1.35-yard D. F.	.18½
72-inch 1.05-yard D. F.	.24¾/.26¼
72-inch 17.21-ounce	.26¾
Mechanicals	
Hose and belting ... lb.	.25
Tennis	
52-inch 1.35-yard ... yd.	16⅜
Hollands	
Gold Seal and Eagle	
20-inch No. 72 ... yd.	.10
30-inch No. 72	.18
40-inch No. 72	.20
Red Seal and Cardinal	
20-inch ... yd.	.08½
30-inch	.15¾
40-inch	.17
50-inch	.26
Osnaburgs	
40-inch 2.34-yard ... yd.	.09½
40-inch 2.48-yard	.09
40-inch 2.56-yard	.08⅜
40-inch 3.00-yard	.07½
40-inch 7-ounce part waste	.08⅛
40-inch 10-ounce part waste	.11¼
37-inch 2.42-yard	.09¼
Raincoat Fabrics	
Cotton	
Bombazine 60 x 64 ... yd.	.07½
Plaids 60 x 48	.10¾
Surface prints 60 x 64	.11¾
Print cloth, 38½-inch, 60 x 64	.04¾
Sheetings, 40-Inch	
48 x 48, 2.50-yard ... yd.	.08
64 x 68, 3.15-yard	.07¾
56 x 60, 3.60-yard	.06¾
44 x 40, 4.25-yard	.04⅞
Sheetings, 36-Inch	
48 x 48, 5.00-yard ... yd.	.04½
44 x 40, 6.15-yard	.03⅝
Tire Fabrics	
Builder	
17¼ ounce 60" 23/11 ply Karded peeler ... lb.	.30
Chafer	
14 ounce 60" 20/8 ply Karded peeler ... lb.	.29½
9¼ ounce 60" 10/2 ply Karded peeler ... lb.	.29
Cord Fabrics	
23/5/3 Karded peeler, 1 1/16" cotton ... lb.	.30½
15/3/3 Karded peeler, 1 1/16" cotton ... lb.	.28½
12/4/2 Karded peeler, 1 1/16" cotton ... lb.	.27½
23/5/3 Karded peeler, 1¼" cotton ... lb.	.36
23/5/3 Combed Egyptian ... lb.	.49½
Leno Breaker	
8¼ ounce and 10¼ ounce 60" Karded peeler ... lb.	.32

COTTON futures prices beyond the July position strengthened somewhat during the past month upon news of adverse weather conditions and only slightly higher acreage as well as the possibility of a relatively high government loan. July futures and the spot market were easier, however, with heavy liquidation of spot cotton. The New York 15/16-inch spot middling price, after closing at 10.93¢ per pound on June 29, declined steadily during July to close at 10.48¢ per pound on July 25.

With the expiration of the July position on July 17, trading in ⅞-inch future contracts in this country came to a halt. Trading now is based on middling 15/16-inch cotton. The quotation of middling ⅞-inch spot cotton at New York, which has been the practice for over a half century, also will be dropped soon. The 1940 government loan, it is expected, will be based on middling 15/16-inch cotton.

The Census Bureau reported June consumption of all cotton, exclusive of linters, in domestic mills at 556,529 bales, against 636,467 in May and 578,436 in June, 1939. Exports of cotton in June totaled 133,530 bales, against 226,469 in May and 113,634 in June, 1939.

Estimating July consumption at 500,000 bales, the total consumption for the crop year ending July 31 would be approximately 7,600,000 bales, the heaviest cotton consumption on record with the exception of the 1936-37 year when absorption totaled 7,950,000 bales. Domestic consumption for 1939-40, together with exports exceeding 6,000,000 bales, will have made inroads into government and private stocks to the extent of about 2,000,000 bales. Heavy domestic consumption will be necessary in the crop year just starting to replace the expected sharp drop in exports, if extensive accumulation of stocks under the 1940-41 government loan are to be prevented.

The Department of Agriculture reported 25,077,000 acres of cotton in cultivation on July 1, up 1.6% from the 24,683,000 acres of planted area last year. This compares with an average area of 34,929,000 acres in cultivation for the period 1929-1938.

Fabrics

The market for fabrics was generally inactive during July. This usual early summer lull, though, was offset to some degree by purchases for defense requirements. In order for mills to maintain current operating schedules, however, it was pointed out that they would need increased civilian business. The sheeting market has been at a standstill for the past month and a half, with production running well ahead of sales. Owing to hot weather, business on raincoats was static, but all manufacturers are preparing now for the fall.

The market in general is easier; tire fabric prices all declined ½¢ per pound, hollands and sheetings were steady; raincoat fabrics were firm. Other fabric prices, which showed a mixed trend, were mostly easier.

Rubber Trade Inquiries

The inquiries that follow have already been answered; nevertheless they are of interest not only in showing the needs of the trade, but because of the possibility that additional information may be furnished by those who read them. The Editor is therefore glad to have those interested communicate with him.

No.	Inquiry
2768	Manufacturer of "Russelloid" for floor covering.
2769	Manufacturers of rubber sponges.
2770	Suppliers of resins extracted from Jelutong.
2771	Manufacturers of machines for retreading and repairing automobile tires.
2772	Manufacturers of machines for making tires, cycle tubes, tennis balls, belting, rubber rings, sheets, and packings, etc.
2773	Manufacturers of rubber cement.
2774	Manufacturers of rubber flooring that can be cemented down.
2775	Manufacturers of rubber labels that can be vulcanized into the outer cover of rubber tubing.
2776	Manufacturers of machines to punch holes in baby nipples.

Rubber and Canvas Footwear Statistics

	Thousands of Pairs		
	Inventory	Production	Shipments
1938	16,183	50,812	54,942
1939	16,388	60,612	60,377
1940			
Jan.	15,018	5,044	6,389
Feb.	15,319	5,062	4,761
Mar.	15,656	4,869	4,532
Apr.	16,881	5,128	3,902
May	18,095	5,075	3,862

The above figures have been adjusted to represent 100% of the industry based on reports received which represented 81% for 1936-37.

Source: *Survey of Current Business*, Bureau of Foreign & Domestic Commerce, Washington, D. C.

Tire Production Statistics

	Pneumatic Casings		
	Inventory	Production	Shipments
1938	8,451,390	40,906,735	43,132,302
1939	8,664,505	57,612,731	57,508,775
1940			
Jan.	9,347,953	4,953,585	4,270,137
Feb.	10,123,824	4,888,250	4,112,379
Mar.	10,747,370	5,007,042	4,345,674
Apr.	10,881,029	5,105,953	5,009,762
May	10,576,217	5,415,314	5,720,249
June	8,984,994	5,127,384	6,718,761

	Pneumatic Casings		
	Original Equipment	Replacement Sales	Export Sales
1938	10,716,130	30,565,008	1,048,934
1939	18,207,556	38,022,034	1,279,185
1940			
Jan.	1,804,826	2,376,455	88,856
Feb.	1,974,466	2,051,487	86,426
Mar.	2,050,250	2,217,627	77,797
Apr.	2,095,220	2,823,293	91,249
May	1,998,735	3,635,652	85,862
June	1,925,582	4,710,750	82,429

	Inner Tubes		
	Inventory	Production	Shipments
1938	8,165,696	37,847,656	40,292,614
1939	7,035,671	50,648,556	51,190,314
1940			
Jan.	7,633,798	4,286,924	3,826,667
Feb.	7,896,960	4,210,904	3,809,733
Mar.	8,182,655	4,399,550	4,113,735
Apr.	8,258,331	4,618,361	4,542,735
May	8,243,050	4,739,072	4,738,668
June	6,914,481	4,347,061	5.675,035

Source: The Rubber Manufacturers Association, Inc. Figures adjusted to represent 100% of the industry.

FINANCIAL

Unless otherwise stated, the results of operations of the following companies are after deductions for operating expenses, normal federal income taxes, depreciation, and other charges, but before provision for federal surtax on undistributed earnings. Most of the figures are subject to final adjustments.

Baldwin Locomotive Works, Philadelphia, Pa., and subsidiaries (including Midvale Co.). Year ended June 30: net profit, $1,734,344, against net loss of $1,-899,666 in the same period a year ago; consolidated sales, $41,849,475, against $21,431,400; consolidated unfilled orders $44,006,811, June 30, against $29,820,569, June 30, 1939.

Brunswick-Balke-Collender Co., Chicago, Ill., and subsidiaries. Six months to June 30: net profit after foreign exchange adjustments, $538,714, equal after preferred dividend requirements, to $1.05 each on 444,455 shares of common stock, against $374,831, or 67¢ each on 441,355 common shares in the first half of 1938.

Collins & Aikman Corp., Philadelphia, Pa., and subsidiaries, except Canadian concern. Quarter ended June 1: net profit, after deductions for depreciation, income taxes, and other charges, $741,085, equal, after preferred dividend requirements, to $1.22 each on 562,800 common shares, against net loss of $34,633 for the quarter ended May 27, 1939.

De Vilbiss Co., Toledo, O. For 1939: net income, $491,135, equal to $4.62 each on 98,644 common shares, against $205,-853, or $1.68 each on 98,641 shares, in 1938.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. June quarter: net income $23,126,507, equal to $2.02 a common share, against $20,796,159, or $1.73 a share, in the 1939 period; sales, $84,514,779, against $78,503,803 in the March quarter of 1940 and $69,743,731 in the second quarter last year.

Dominion Textile Co., Ltd., Montreal, P. Q., Canada. Year ended March 31: net income, $2,214,070, after interest, depreciation, amortization, income tax provision, premium on bonds redeemed, and other charges, equal, after dividend requirements on the 7% preferred stock, to $7.70 a share on 270,000 common shares, against $1,036,982, or $3.34 a common share, in the preceding fiscal year. Earnings for the year were before provision for $250,000 for pension fund reserve and $261,021 unamortized premium and bond discount, which was written off.

Endicott Johnson Corp., Johnson City, N. Y., and subsidiaries. Fifty-two weeks to June 1: net profit, $1,291,991, against $1,261,358 for 53 weeks to June 3, 1939.

Firestone Tire & Rubber Co., Akron, O., and subsidiaries. Six months ended April 30: consolidated net profit, $2,-565,661, after depreciation, interest, federal income taxes, and provision of $500,000 additional reserve for future declines in foreign exchange and other contingencies, equal, after dividend requirements on the 6% preferred stock, to 60¢ each on 1,933,992 shares of $10-par common, contrasted with $2,851,538, or 75¢ each on the 1,936,458 common shares outstanding, in the corresponding period last year .

General Electric Co., Schenectady, N. Y. First half, 1940: net profit, $25,-981,572, equal to 90¢ a common share, against $16,370,192, or 57¢ a share, in the first half of 1939; net sales, $191,-619,132, against $146,299,212.

General Tire & Rubber Co., Akron, O., and subsidiaries. Six months to May 31: net profit, $280,563, equal, after dividend requirements on 24,871 shares of $6 preferred stock, to 39¢ each on 526,427 shares of $5-par common stock, against $1,103,575, or $1.96 each on 522,927 common shares, for last year's period; net sales, $10,167,972, against $10,917,346.

The B. F. Goodrich Co., Akron, O. First half, 1940: consolidated net profit, $1,362,691, after depreciation, interest, and federal income taxes, equal to 26¢ a share on the common stock after preferred dividend requirements, against consolidated net profit in the same period of last year of $3,122,728, including non-recurring profits of $415,188, and the results of operations of certain foreign subsidiaries not now consolidated; consolidated net sales, $67,502,-026, 6.4% above those of the first half of 1939; current assets, $75,176,134; current liabilities, $13,044,838.

Hercules Powder Co., Wilmington, Del. First half, 1940: net earnings, $3,293,066, after provisions for depreciation, federal income taxes, and other charges, equal, after preferred dividend requirements, to $2.30 each on 1,316,710 shares of common stock, against $2,-269,470, or $1.52 a common share, in the first half of 1939.

Hewitt Rubber Corp., Buffalo, N. Y. Six months to June 30: net earnings, $102,371 or 61¢ a share, against $81,053, or 48¢ a share last year. June quarter: net earnings, $63,994 or 38¢ a share, against 23¢ a share in the March quarter.

Lee Rubber & Tire Corp., Conshohocken, Pa. Six months to April 30: consolidated net profit, $456,094, equal to $1.70 a share on 268,343 capital shares, against $652,972, or $2.55 a share on 255,565 shares for the comparable period last year.

Monsanto Chemical Co., St. Louis, Mo., and U. S. subsidiaries. June quarter: net profit, $1,465,689 after depreciation, obsolescence, federal income taxes, and other charges, equal to $1.07 each on the 1,241,694 shares of common stock after dividend requirements on the preferred stock and allowing for minority interest contrasted with $1,-634,208, or $1.23 a common share in the March quarter and $918,801, or 64¢ a common share in the second quarter of 1939. First half, 1940: net profit, $3,107,726, equal, after preferred dividend requirements and minority interest to $2.30 a common share, against $2,061,065, or $1.46 a common share in the first half of 1939. Earnings for the six months this year included $270,375 dividends from a British subsidiary.

Pirelli Co. of Italy, Milan, Italy. For 1939: net income of parent company only, 52,846,000 lire, against 1938 net income of 43,581,000 lire.

Raybestos-Manhattan, Inc., Passaic, N. J. March quarter: net profit, $434,-441, equal to 68¢ each on 631,200 shares of no par capital stock, excluding earnings of the wholly owned Canadian subsidiary, against net profit of $316,-401, or 50¢ each, on 632,000 shares in the first quarter last year.

Rome Cable Corp., Rome, N. Y. June quarter: net profit, $60,570, equal to 32¢ a share on the outstanding stock, against $45,993, or 24¢ a share, in the same period last year.

Russell Mfg. Co., Middletown, Conn. Six months to May 31: net income, $71,331, equal to $1.54 each on 46,240 shares; sales, $1,993,891.

St. Joseph Lead Co., New York, N. Y. First half, 1940: net income, $2,576,-820, equal to $1.31 a share, against $1,415,028, or 72¢ a share, the same period last year.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Anaconda Wire & Cable Co.	Com.	$0.25 resum.	July 12	July 5
Collyer Insulated Wire Co.	Com.	$0.20 irreg.	July 1	June 24
Dayton Rubber Mfg. Co.	"A" Pfd.	$0.50 q.	Aug. 1	July 20
De Vilbiss Co.	Com.	$0.75	July 15	June 29
De Vilbiss Co.	Pfd.	$0.175 q.	July 15	June 29
Hercules Powder Co.	Pfd.	$1.50 q.	Aug. 15	Aug. 2
Lee Rubber & Tire Corp.	Com.	$0.75	Aug. 1	July 15
Midwest Rubber Reclaiming Co.	$4 Pfd.	$1.00 q.	Sept. 3	Aug. 20
Midwest Rubber Reclaiming Co.	Com.	$0.25	Aug. 1	July 20
Pahang Rubber Co., Ltd.	Com.	$0.15	June 28	June 22
Philadelphia Insulated Wire Co.	Com.	$0.10 s.	Aug. 15	Aug. 1
S. S. White Dental Mfg. Co.	Com.	$0.15 q.	Aug. 13	July 29

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

GENERAL RATES	SITUATIONS WANTED RATES	SITUATIONS OPEN RATES
Light face type $1.00 per line (ten words)	Light face type 40c per line (ten words)	Light face type 75c per line (ten words)
Bold face type $1.25 per line (eight words)	Bold face type 55c per line (eight words)	Bold face type $1.00 per line (eight words)

Allow nine words for keyed address. *Replies forwarded without charge.*

SITUATIONS WANTED

ORGANIC CHEMIST, M.S., M.I.T., SIXTEEN YEARS IN RESEARCH, Development, and Production. Intimate knowledge of latex sponge processes. Good diversified background in Organic and Inorganic Chemistry. Excellent references. Available immediately. Address Box No. 123, care of INDIA RUBBER WORLD.

CHEMIST, 15 YEARS' EXPERIENCE COMPOUNDING, ENGINEERING, and supervision for tires, tubes, mechanicals, and adhesives. Address Box No. 131, care of INDIA RUBBER WORLD.

CHEMIST, OVER 20 YEARS IN THE RUBBER INDUSTRY ON development, research, production and sales engineering. Experienced in mechanicals, tires, all types of adhesives, and other branches, would like a position of responsibility. Address Box No. 132, care of INDIA RUBBER WORLD.

SITUATIONS OPEN

POSITION OPEN FOR PATTERN MAKER ON RUBber and fabric footwear. Address Box No. 126, care of INDIA RUBBER WORLD.

MAN EXPERIENCED IN RUBBER COMPOUNDING, VULCANIZing, and cost accounting. State age, education, experience, former employers, references, and other details. Address Box No. 128, care of INDIA RUBBER WORLD.

SITUATIONS OPEN (Continued)

WANTED: THOROUGHLY EXPERIENCED EXECUTIVE PLANT engineer for miscellaneous rubber manufacture; Eastern city; permanent; all replies confidential. Address Box No. 129, care of INDIA RUBBER WORLD.

WANTED: MAN EXPERIENCED MANUFACTURING RUBBER bands, tubing, curing, cutting, etc., take charge of department. Good opportunity, factory located L. I. C., N. Y. Address Box No. 130, care of INDIA RUBBER WORLD.

BUSINESS OPPORTUNITIES

FOR RENT: RUBBER PLANT COMPLETE WITH 12 PRESSES, one 16" and two 40" mills, small calender, modern vulcanizer, three tubers, laboratory mill and press. Low power, steam, and water costs. Excellent facilities for manufacturing molded and extruded rubber products. Located short distance from New York. Further full particulars on request. Address Box No. 124, care of INDIA RUBBER WORLD.

A MAN CAPABLE OF OPERATING SMALL MOLDED AND EXtruded Rubber Plant can secure a ½ interest. Now operating at a profit. You must be able to handle men and produce. $8,000 required. Middle West location. Address Box No. 125, care of INDIA RUBBER WORLD.

(Advertisements continued on page 89)

Obituary

(*Continued from page 62*)

Richard W. Rhoades

PNEUMONIA caused the death, on June 29, at his home in Mt. Vernon, N. Y., of Richard Winfield Rhoades, retired president and chairman of the board of R. W. Rhoades Metaline Co., Inc., Long Island City, N. Y. Born in New York, N. Y., on August 12, 1856, he began earning his living by selling papers. Then for a while he was an office worker for a New York lawyer. Next he became bookkeeper with the North American Metaline Co., advancing himself to become owner of the firm in 1891. The name was changed to its present one on April 1, 1926. Although Mr. Rhoades had been inactive in business for the past two decades, he remained as chairman and president of the concern until 1938.

The deceased was a director of the First National Bank of Mt. Vernon, of the Methodist Hospital in Brooklyn, and of the Danbury (Conn.) Home for the Aged, a member of the Quill Club, a former member of the board of managers of Mt. Vernon Hospital, and a former trustee of the local Y. M. C. A. branch. He was also well known as a philanthropist.

Funeral services were held on July 1 at his late residence. Burial was in Kensico Cemetery, Valhalla, N. Y.

Mr. Rhoades is survived by three cousins, two of whom, B. Richard and Norman W. Rhoades, are president and treasurer, respectively, of the R. W. Rhoades Metaline Co.

Warren T. Lewis

AFTER a month's illness Warren T. Lewis, for many years the crude rubber purchasing agent of the Firestone Tire & Rubber Co., Akron, O., died on June 24. He had joined the company in October, 1911, and his entire service was spent in its purchasing department. During the World War, however, his stay with Firestone was interrupted while he was engaged in military duty.

Mr. Lewis, who was born in Cleveland, O., on April 4, 1889, was a former president of the Y. M. C. A. Men's Club, a trustee of the Westminster Presbyterian Church, Akron, and a member of the Portage Country Club.

He leaves his wife, a son, his father, and two brothers.

Funeral services were conducted on June 27, with interment in Rose Hill Cemetery, Akron.

R. H. Greene

RICHARD HUGHES GREENE, 90, who retired in 1925 as secretary and director of Gutta Percha & Rubber, Ltd., Toronto, Ont., Canada, died suddenly on May 27 in New Mexico while on his way home to Toronto from California. Mr. Greene was widely known in the boot and shoe business with which he had been associated both in Hamilton and Toronto before joining the Gutta Percha concern. For about a quarter-century he had also been secretary of the Rubber Shoe Manufacturers Association.

He leaves his wife and three sons.

Funeral services were held in Toronto on May 31.

George S. Knapp

GEORGE S. KNAPP, 75, partner in the crude rubber brokerage of Paterson-Boardman & Knapp, 10 Bridge St., New York, N. Y., died suddenly on July 8 of a heart attack near his home in Scarsdale, N. Y. He was also a director of the Atlantic Mutual Insurance Co. and a former trustee of the Marcy Ave. Baptist Church, Brooklyn, N. Y. He leaves his wife, a son, a daughter, and two sisters. Funeral services were conducted July 10 at the Community Baptist Church, Scarsdale.

J. Gordon Glen

J. GORDON GLEN, 53, died suddenly at his home in Trenton, N. J., on July 11 from a heart attack. A native of England, he came here many years ago. At first he was the representative of R. & J. Bick, Ltd., Glasgow, Scotland, with offices in New York, N. Y., and covered the territory east of the Mississippi. He later became sales manager of the hard rubber division of the United States Rubber Co., New York, and for the past seven years was development engineer for the Jos. Stokes Rubber Co., Trenton.

Surviving are his wife, a daughter, two sons, and a sister. Services were held in the Greenwood Cemetery, Brooklyn, N. Y.

Current Quotations

(*Continued from page 82*)

Stabilizers for Cure		
Laurex (*bags*) ....*lb.*	.1075/	.1325
Stearex B ....*lb.*	.0925/	.1025
Beads ....*lb.*	.09 /	.10
Stearic acid, single pressed.*lb.*	.0925/	.1025
Stearite, *c.l.*..........100 *lbs.*	9.00	
Zinc stearate ....*lb.*	.23 /	.25
Synthetic Rubber		
Neoprene Type E.........*lb.*	**.65**	
G ....*lb.*	**.70**	
GN ....*lb.*		
GW ....*lb.*	**.75**	
H ....*lb.*	**.78**	
M ....*lb.*	**.65**	
Latex Type 57..........*lb.*	**.30**	
Synthetic 190 ....*lb.*	.55	
Tackifier		
B.R.H. No. 2.............*lb.*	.017 /	.02
Varnish		
Shoe ....*gal.*	**1.45**	
Vulcanizing Ingredients		
Sulphur ....100 *lbs.*	2.00	
Chloride (*drums*) ....*lb.*	.035 /	.04
Telloy ....*lb.*	**1.75**	
Vandex ....*lb.*	**1.75**	
(See also Colors—Antimony)		
Waxes		
Carnauba, No. 3 chalky....*lb.*		
2 N.C. ....*lb.*		
3 N.C. ....*lb.*		
1 Yellow ....*lb.*		
2 ....*lb.*		
Montan, crude ....*lb.*		

Shipments of Crude Rubber from Producing Countries—Long Tons

Year	Malaya including Brunei and Labuan	N.E.I.	Ceylon	India	Burma	North Borneo	Sarawak	Thailand	French Indo-China	Total	Philippines and Oceania	Liberia†	Other Africa	South America	Mexican Guayule	Grand Total
1938......	372,000	298,100	49,500	8,500	6,700	9,500	17,800	41,600	59,200	862,900	2,000*	2,900	9,000*	15,300	2,800	894,900
1939......	376,755	371,946	61,028	9,241	6,616	11,864	24,014	41,266	65,219	967,949	2,080*	5,435	9,600*	16,094	2,861	1,004,019
1939																
Jan.	24,393	38,680	7,237	764	1,115	1,604	2,342	2,918	4,532	83,585	220	528	800	1,812	347	87,292
Feb.	29,278	24,996	5,495	947	618	664	1,484	5,606	5,293	74,381	158	435	800	1,187	319	77,280
Mar.	29,298	27,933	3,718	773	619	344	1,177	5,401	4,501	73,764	230	427	800	1,407	210	76,838
Apr.	29,779	28,338	2,225	881	379	1,687	2,446	2,660	2,657	71,052	135	533	800	1,206	167	73,893
May	29,598	24,429	2,805	1,002	668	558	1,649	2,782	4,584	68,075	129	...	800	1,077	231	70,312
June	22,052	27,510	3,707	630	805	332	1,157	1,748	4,663	62,604	140	667	800	676	166	65,053
July	26,013	35,679	5,019	782	503	1,603	3,092	5,599	3,367	81,657	190	516	800	1,071	264	84,498
Aug.	40,973	27,477	5,620	203	213	975	1,749	5,230	7,020	89,460	234	222	800	1,313	378	92,407
Sept.	26,908	37,755	6,064	691	89	429	1,932	4,670	5,943	84,481	94	599	800	1,356	46	87,376
Oct.	49,458	44,998	5,234	665	150	1,730	2,487	2,047	5,022	111,791	122	561	800	1,524	356	115,154
Nov.	35,773	30,234	4,402	370	449	1,322	2,023	1,428	6,540	82,541	254	614	800	1,198	137	85,544
Dec.	33,232	23,917	9,502	1,533	1,008	616	2,476	1,177	11,097	84,558	174	333	800	2,267	240	88,372
1940																
Jan.	26,229	54,148	7,698	839	833	1,858	2,256	5,722	5,238	104,821	120	1,191	900	1,550	128†	108,710
Feb.	45,651	37,958	8,946	2,017	892	1,164	2,678	4,307	6,931	110,544	94	477	900	1,662	314†	113,991
Mar.	47,885	42,407	5,305	1,183*	871	1,050	3,526	3,111	3,551	108,889	200*	548	900	1,482	365*	112,384
Apr.	25,454	44,357	4,148	1,183*	990	1,799	2,951	1,834	2,927	85,643	200*	598	900	1,159	314	88,814
May	57,874	40,218	7,341	1,183*	1,046	1,370	2,696	2,582	4,500*	118,810	200*	600*	900	1,500*	200*	122,210

* Estimated. †Guayule rubber imports into U.S.A. provisional until export figures from Mexico are received. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

Classified Advertisements

Continued

MACHINERY AND SUPPLIES FOR SALE

CONSOLIDATED OFFERS: Battery of Semi-Automatic Presses, 75 to 400 ton, complete with pull-backs and ejectors; 60" Mixing Rolls; 66" 3-roll Calender; 7-Gould Triplex Hydraulic Pumps, 3-1500 PSI, 35 GPM, 4-3000 PSI, 18 GPM; 2-Watson-Stillman 4-cylinder opposed Hydraulic Pumps, 6000 lb. PSI, 25 GPM, motor driven, 100 HP AC motors; Watson-Stillman Hydro-Pneumatic Accumulator, 8" ram, 48" stroke, 42" air cylinder, 5000 lb. PSI, complete with high-pressure air receiver and inter-connecting fittings. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, N. Y. C.

FOR SALE: ONE 6 x 12 THROPP LABORATORY MILL, 220-VOLT, three-phase, 60-cycle motor, set of scrapers, new 1937, used less than 100 hours, price $750 for quick sale. VERNET PATENTS CO., Yellow Springs, Ohio.

MACHINERY AND SUPPLIES WANTED

WANTED FOR USER: 1—NO. 3 OR NO. 9 BANBURY MIXER; 3—Mills; 1—Calender; 5—Hydraulic Presses, with pumps and accumulators; 2—Tubers. No dealers. Address Box No. 127, care of INDIA RUBBER WORLD.

Dominion of Canada Statistics

Imports of Crude and Manufactured Rubber

	April, 1940		Four Months Ended April, 1940	
UNMANUFACTURED	Quantity	Value	Quantity	Value
Crude rubber, etc. ....lb.	6,856,788	$1,432,385	32,361,789	$6,661.475
Latex (dry weight) ......lb.	70,035	23,719	594,517	169,128
Gutta percha ....lb.	......	......	5,860	3,983
Rubber, covered ....lb	1.523,200	77,564	4,849,900	257,947
Rubber, powdered, and gutta percha scrap ....lb.	575,100	9,284	2,163,400	40,377
Balata ....lb.	1,328	1,585	2,608	2,458
Rubber substitute ....lb.	15,600	2,353	98,800	24,436
Totals	9,042,051	$1,546,890	40,076,874	$7,159,804
PARTLY MANUFACTURED				
Hard rubber comb blanks...	......	$2,609	......	$10.572
Hard rubber, n. o. s......lb.	4,746	3,397	18,235	16,850
Rubber thread no covered.lb.	7,872	6,719	20,076	18,877
Totals	12,618	$12,725	38,311	$46.299
MANUFACTURED				
Bathing shoes ....prs.	11,605	$3,062	11,749	$3,089
Belting	......	11,773	......	49,508
Hose	......	14,879	......	58,928
Packing	......	9,282	......	31,069
Boots and shoes........prs.	838	898	2,839	4,019
Canvas shoes with rubber soles ....prs.	24,304	6,103	27,415	7,191
Clothing, including waterproofed	......	4,198	......	14,020
Raincoats ....no.	4,396	18,312	10,051	40,351
Gloves ....doz. prs.	1,115	3,959	3,014	10,355
Hot water bottles..........	......	56	......	1,277
Liquid rubber compound....	......	21,786	......	105,610
Tires, bicycle ....no.	2,053	1,182	16,457	9,638
Pneumatic ....no.	1,865	24,788	5,823	85,393
Solid for automobiles and motor trucks ....no.	5	260	123	3,132
Other solid tires..........	......	408	......	2,795
Inner tubes ....no.	618	1,476	2,159	5,117
Bicycle ....no.	1,067	223	13,109	2,830
Mats and matting..........	......	4,767	......	25,198
Cement	......	7,607	......	37,801
Golf balls ....doz. prs.	7,919	15,882	12,395	23,863
Heels ....prs.	5,847	372	25,720	2.151
Other rubber manufactures..	......	141,248	......	615,587
Totals	......	292,521	......	1,138.922
Totals, rubber imports..	......	1,852,136	......	8,345.025

Exports of Domestic and Foreign Rubber Goods

UNMANUFACTURED	Produce of Canada Value	Reexports of Foreign Goods Value	Produce of Canada Value	Reexports of Foreign Goods Value
Waste rubber	$13,544	......	$49,466	......
MANUFACTURED				
Belting	$37,346	......	$194,422	......
Bathing caps	90	......	153	......
Canvas shoes with rubber soles	37,483	......	231,878	......
Boots and shoes	307,903	......	1,621,052	......
Clothing, including waterproofed	23,532	......	117,636	......
Heels	16,624	......	57,640	......
Hose	31,029	......	158,019	......
Soles	22,750	......	74,990	......
Soling slabs	3,271	......	17,513	......
Tires, pneumatic	458,123	......	2,220,933	......
Not otherwise provided for	......	......	56	......
Inner tubes	37,959	......	177,771	......
Other rubber manufactures.	41,679	$18,083	214,838	$28,518
Totals	$1,017,789	$18,083	$5,086,901	$28.518
Totals, rubber exports.	$1,031,333	$18,083	$5,134.567	$28,518

Imports by Customs Districts

	May, 1940 *Crude Rubber		May, 1939 *Crude Rubber	
	Pounds	Value	Pounds	Value
Massachusetts	12,615,224	$2,299,017	14,320,264	$2,295,838
New York	79,365,234	13,851,378	66,497,485	10,509,405
Philadelphia	1,964,115	321,368	981,342	144,961
Maryland	6,313,057	1,078,396	2,311,517	336,550
Mobile	332,850	56,166	1,567,901	220,397
New Orleans	8,614,364	1,489,862	7,930.713	1.229.189
El Paso	67,200	5,820	......	......
Los Angeles	4,362,722	738,611	8,215,244	1,249,549
San Francisco	420,343	73,656	831,044	126,788
Oregon	28,000	4,200	16,800	2,662
Colorado	......	......	112,000	16,123
Ohio	771	180	......	......
Tennessee	1,121,990	174,758	......	......
Totals	115,205,870	$20,093,412	102.784.310	$16.131.462

*Crude rubber including latex dry rubber content.

United States Statistics

Imports for Consumption of Crude and Manufactured Rubber

	April, 1940		Four Months Ended April, 1940	
	Quantity	Value	Quantity	Value
UNMANUFACTURED—*Free*				
Liquid latex (solids) . . . . . *lb.*	8,430,063	$1,608,156	28,547,667	$5,441.464
Jelutong or pontianak . . . . *lb.*	1,132,357	176,064	4,749,174	629.005
Balata . . . . *lb.*	112,817	18,289	412,596	85.082
Gutta percha . . . . *lb.*	414,789	56,244	1,771,249	243,353
Guayule . . . . *lb.*	703.900	65,313	2,510,400	244,646
Scrap and reclaimed . . . . . *lb.*	731,222	9,714	2,873,527	48,786
Totals	11,525,148	$1,933,780	40,864,613	$6,692.336
Misc. rubber (above), 1,000 *lbs.*	11,525,148	$1,933,780	40,864,613	$6,692,336
Crude rubber . . . . . . 1,000 *lbs.*	149,233	26,176,442	519,007	89,914,749
Totals . . . . 1,000 *lbs.*	11,674,381	$28,110.222	41,383,620	$96,607,085
Chicle, crude . . . . *lb.*	367,754	$121,443	3,920,906	$1,268,678
MANUFACTURED—*Dutiable*				
Rubber tires . . . . *no.*	4,095	$21,958	25,812	$166,273
Rubber boots, shoes and overshoes . . . . *prs.*	6,618	977	15,105	3,073
Rubber soled footwear with fabric uppers . . . . *prs.*	99,454	22,110	328,948	56,096
Golf balls . . . . *no.*	97,764	7,930	262,406	23.383
Lawn tennis balls . . . . *no.*	156,552	16,480	581,580	54,921
Other rubber balls . . . . *no.*	201,952	6,605	878,396	32,130
Other rubber toys . . . . *lb.*	. . . . . .	1,154	. . . . . .	11,895
Hard rubber combs . . . . . . *no.*	. . . . . .	. . . . . .	. . . . . .	. . . . . .
Other manufactures of hard rubber	. . . . . .	1,476	. . . . . .	8,491
Friction or insulating tape . *lb.*	6,327	6,472	24,500	16.097
Belts, hose, packing, and insulating material	. . . . . .	1,172	. . . . . .	33,081
Druggists' sundries of soft rubber	. . . . . .	7,903	. . . . . .	18,780
Inflatable swimming belts, floats, etc. . . . . *no.*	55,124	3,632	400,231	26.241
Other rubber and gutta percha manufactures	. . . . . .	32,628	. . . . . .	86,632
Totals	995,640	$251,940	6,437,884	$1,805,771

Exports of Foreign Merchandise

	April, 1940		Four Months Ended April, 1940	
	Quantity	Value	Quantity	Value
RUBBER AND MANUFACTURES				
Crude rubber . . . . *lb.*	1,264,696	$252,638	8,480,021	$1,747,590
Balata . . . . *lb.*	12,415	4,984	238,410	74,676
Other rubber, rubber substitutes and scrap . . . . *lb.*	132,495	18,150	134,756	18.482
Rubber manufactures (including toys)	. . . . . .	8,266	. . . . . .	20,875
Totals	1,409,606	$284,038	8,853,187	$1,861,623

Exports of Domestic Merchandise

	April, 1940		Four Months Ended April, 1940	
	Quantity	Value	Quantity	Value
RUBBER AND MANUFACTURES				
Reclaimed . . . . *lb.*	2,188,973	$107,532	10,957,068	$562,794
Scrap . . . . *lb.*	8,114,167	145,178	29,772,313	571.063
Cements . . . . *gal.*	56,221	69,435	163,078	206.178
Rubberized auto cloth . *sq. yd.*	14,706	7,092	79,372	37,101
Other rubberized piece goods and hospital sheeting . *sq. yd.*	163,009	64,251	732,637	259,609
Boots . . . . *prs.*	2,484	6,628	62,725	131,186
Shoes . . . . *prs.*	41,581	17,594	96,168	54,097
Canvas shoes with rubber soles . . . . *prs.*	60,905	46,002	154,771	120.679
Soles . . . . *doz. prs.*	6,010	11,106	17,800	32,794
Heels . . . . *doz. prs.*	23,941	11,737	107,547	62,978
Soling and top lift sheets . *lb.*	30,570	6,509	356,282	64,424
Gloves and mittens . . *doz. prs.*	6,683	15,586	46,048	103.583
Water bottles and fountain syringes . . . . *no.*	29,556	9,260	103,747	34.552
Other druggists' sundries . . .	. . . . . .	56,537	. . . . . .	282,012
Gum rubber clothing . . . . *doz.*	22,453	55,373	75,013	193,399
Balloons . . . . *gross*	16,573	17,329	77,625	70,845
Toys and balls	. . . . . .	14,537	. . . . . .	36,622
Bathing caps . . . . *doz.*	9,261	14,306	24,021	41,357
Bands . . . . *lbs.*	17,635	7,676	86,744	42,947
Erasers . . . . *lb.*	22,536	13,672	100.655	59.139
Hard rubber goods				
Electrical battery boxes . *no.*	18,401	13,135	94,403	67,095
Other electrical . . . . *lb.*	62,164	25,292	213,457	91,248
Combs, finished . . . . . . *doz.*	26,111	12,832	77,890	40,521
Other hard rubber goods . . .	. . . . . .	13,227	. . . . . .	54.346
Tires				
Truck and bus casings . *no.*	25,051	543,589	126,840	2,637,638
Other auto casings . . . . *no.*	48,731	536,026	204,507	2,245,012
Tubes, auto . . . . *no.*	48,885	88,094	225,686	413,024
Other casings and tubes . *no.*	12,864	140,780	32,959	277,428
Solid tires for automobiles and motor trucks . . . . *no.*	628	11,138	1,832	38,317
Other solid tires . . . . *lb.*	7,407	1,814	71,212	13,784
Tire sundries and repair materials . . . . *lb.*	187,862	52,320	944,470	272,709
Rubber and friction tape . . *lb.*	60,731	16,413	306,832	84,513
Fan belts for automobiles . *lb.*	39,995	26,586	166,988	92,606
Other rubber and balata belts . . . . *lb.*	192,565	110,279	1,300,756	666,611
Garden hose . . . . *lb.*	61,019	10,347	315,208	54,340
Other hose and tubing . . . . *lb.*	446,425	198,796	2,723,848	1,102,116
Packing . . . . *lb.*	89,365	49,178	473,226	231,096
Mats, matting, flooring, and tiling . . . . *lb.*	89,791	11,372	397,702	53,350
Thread . . . . *lb.*	75,478	53,358	392,748	273,994
Gutta percha manufactures . *lb.*	383,067	109,218	848,828	244,074
Latex (d.r.c.) and rubber sheets processed for further manufacture . . . . *lb.*	105,635	34,274	448,522	101,569
Other rubber manufactures . .	. . . . . .	269,892	. . . . . .	845,225
Totals	12,809,439	$3,025,300	52,379,528	$12,867,975

U. S. Crude and Waste Rubber Imports for 1940

	Plantations	Latex	Paras	Africans	Centrals	Guayule	Totals 1940	Totals 1939	Balata	Miscellaneous	Waste
Jan. ....tons	68,832	2,768	406	161	74	255	72,496	37,082	107	648	241
Feb.	40,338	1,458	553	453	30	256	43,088	31,038	75	316	34
Mar.	56,008	2,720	119	40	42	320	59,258	45,724	89	659	26
Apr.	66,688	3,219	374	97	12	309	70,699	32,031	63	581	8
May	47,321	2,883	729	186	24	288	51,431	45,886	150	596	204
June	50,785	2,365	267	146	1	325	53,889	34,363	83	494	20
Total 6 mos., 1940 .....tons	329,972	15,413	2,448	1,092	183	1,753	350,861	......	567	3,294	533
Total 6 mos., 1939 .....tons	211,733	9,309	2,246	1,557	27	1,252	......	226,124	389	3,851	815

Compiled from The Rubber Manufacturers Association, Inc., statistics.

United States Latex Imports

Year	Pounds (d.r.c.)	Value
1938	26,606,048	$ 4,147,318
1939	61,460,003	10,467,552
1940		
Jan.	7,639,568	1,412,728
Feb.	4,862,684	947,524
Mar.	7,561,780	1,473,056
Apr.	8,430,063	1,608,156
May	8,029,276	1,523,879

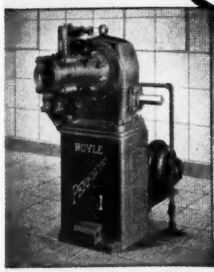
Data from Leather and Rubber Division, Washington, D. C.

World Net Imports of Crude Rubber—Long Tons

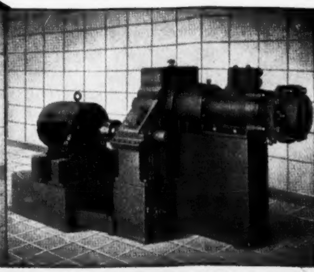
Year	U.S.A.	U.K.†	Argentine	Australia	Belgium	Canada	France	Greater Germany‡	Italy	Japan	Poland	Sweden	U.S.S.R.	Rest of World	Total
1938...	406,300	168,172	7,700	12,300	11,300	25,700	58,100	107,900	28,200	46,300	7,900	8,300	26,800	49,200	928,000
1939...	486,348	....	9,552	15,426	9,593	32,508	....	....	....	42,351	....	....	....	61,866	....
1939															
Jan. ..	36,614	7,121	417	954	898	2,867	4,694	9,095	2,133	2,553	665	643	4,000*	4,284	70,651
Feb. ..	30,578	8,087	1,092	1,785	1,068	1,451	5,327	8,348	2,025	3,263	709	467	1,000*	4,824	66,710
Mar. ..	45,286	12,092	440	1,324	1,242	2,458	4,503	9,028	1,525	4,019	985	581	2,000*	4,901	86,374
Apr. ..	31,590	7,129	786	1,138	855	1,559	5,650	9,316	1,926	3,579	673	994	2,000*	4,614	69,432
May ..	45,390	10,488	353	1,202	792	3,069	4,646	9,031	1,573	4,438	940	1,047	1,000*	5,818	86,830
June ..	33,950	10,287	965	1,348	621	2,465	4,649	8,677	1,992	3,067	693	2,252	500*	4,800	74,295
July ..	36,932	6,205	983	1,472	836	3,214	4,282	8,849	1,408	3,668	750*	644	1,000*	4,541	72,520
Aug. ..	38,319	9,391	619	2,182	952	2,187	....	....	....	3,146	....	1,057	2,500*	5,286	77,030
Sept. ..	36,197	....	965	875	108	2,639	....	....	....	2,801	....	280	....	5,046	....
Oct. ..	39,735	....	562	1,335	519	5,787	....	....	....	2,749	.....	....	....	4,906	....
Nov. ..	41,478	....	359	905	667	1,709	....	....	....	5,106	....	....	....	5,883	....
Dec. ..	70,279	....	2,011	906	1,054	3,103	....	....	....	3,962	....	....	....	6,963	....
1940															
Jan. ..	71,541	....	1,049	921	891	5,047	....	....	....	4,547	....	....	....	....	....
Feb. ..	41,797	....	565	1,846	694	3,508	....	....	....	5,243	....	....	....	....	....
Mar. ..	58,283	....	756	1,784	....	3,062	....	....	....	6,057	....	....	....	....	....
Apr. ..	69,962	....	....	1,612	....	3,096	....	....	....	....	....	....	....	....	....

* Estimated. †U. K. figures show gross imports, not net imports. ‡Including imports of Austria and Czechoslovakia. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

85th Anniversary



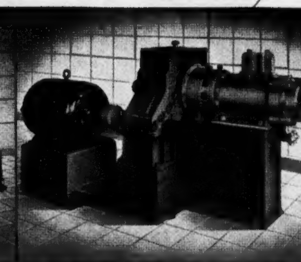
2 -inch Tubing Machine



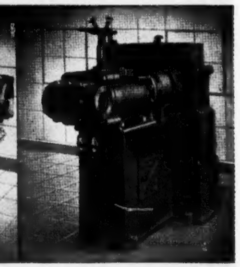
3¼-inch Strainer, bolted head

3¼-inch Tuber, with soapstoning equipment

Resin-Type Extruder arranged for wire-covering



4½-inch Tubing Machine, drive side, showing typical motor application

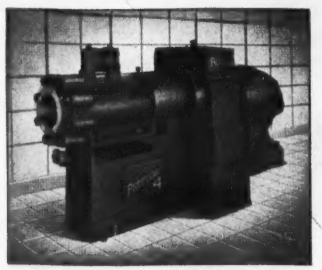


4½-inch Insulating Machine

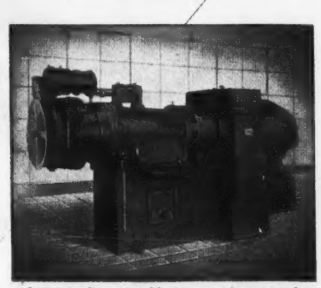
1855-1880-1940... Milestones

Throughout these unfolding years we have been privileged to build Royle Machinery for manufacturers in almost every country in the world. We are grateful for these opportunities and covet for our friends in the rubber industry every success . . . and for ourselves your continued friendship and respect. By this we measure our success.

Tomorrow, and for years to come, purchasers will find us here servicing existing machines and continuing leadership in the further development of Royle Extruding Machines for the rubber and plastic industries.



6-inch Tubing Machine



8½-inch Straining Machine, with patented expansion head and lever-operated breech-lock

1855-1880-1940... Milestones

Eighty-five years' experience has been livened by young ideas. Today, sixty years after introducing the first tubing machine, we proudly present Royle Extruding Machines that are in every sense the *Aristocrats* of the industry, with enclosed self-lubricating worm or herringbone gear drive; roller thrust bearings; hard, corrosion-resistant cylinder liners; stock screws engineered for individual applications; efficient die-heads for every form of tubing, straining, insulating.

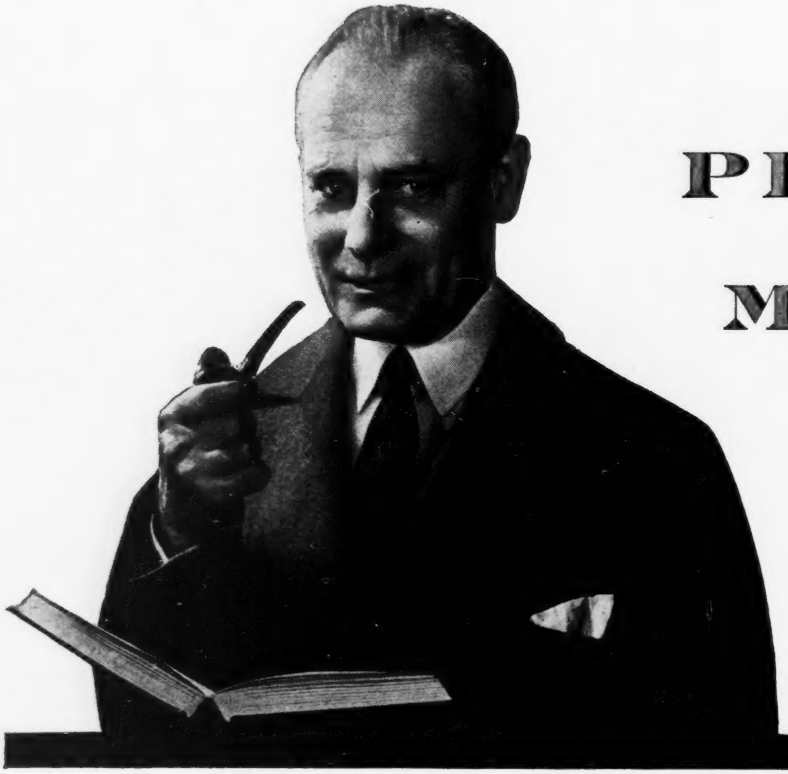
JOHN ROYLE & SONS

PATERSON, NEW JERSEY

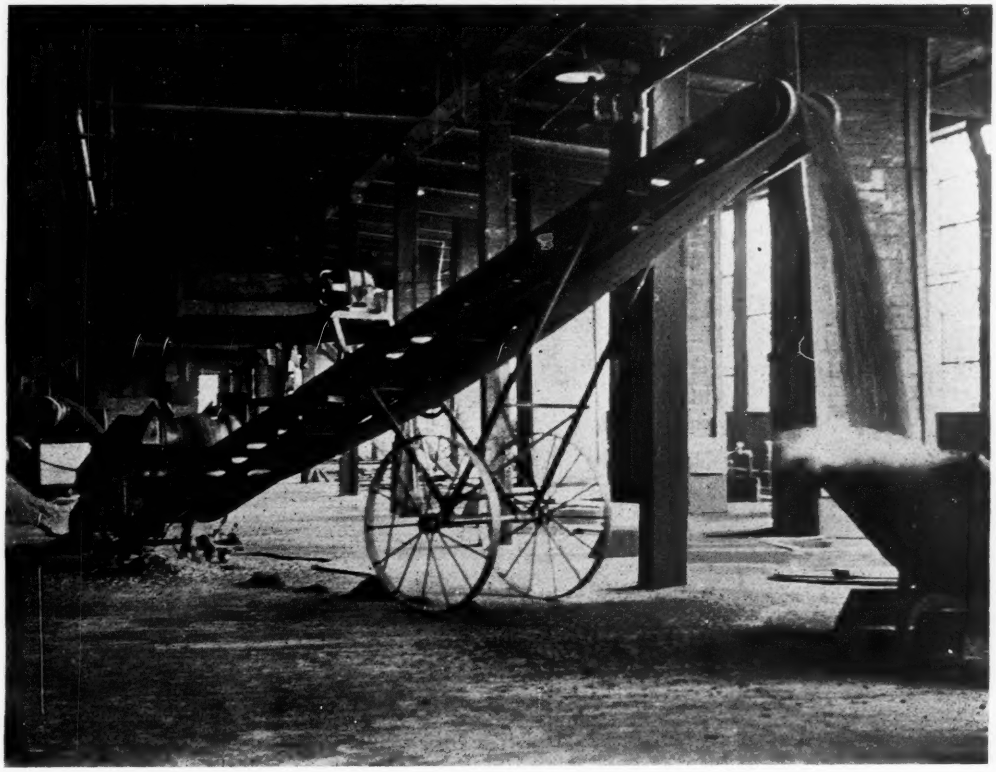
AKRON, OHIO:
J. C. CLINEFELTER

LONDON, ENG.:
JAMES DAY (MACHINERY) Ltd.


66
DUSTLESS CARBON BLACKS
DIXIEDENSED
KOSMOBILE
UNITED CARBON COMPANY
CHARLESTON, W. VIRGINIA



A Cataract of "CRACKED" Rubber Flows Continuously Into Defiberizing Vats



Ground rubber scrap leaves the "Crackers" after it has been reduced in size to allow it to pass through screens of specified mesh.

The enormous capacity of Pequanoc's equipment causes a veritable cataract of cracked rubber scrap to continuously flow, day and night into the huge defiberizing vats. Particles of iron and steel are removed by magnets during this operation.

In the defiberizing vats the fabric is destroyed. The remaining foreign metal is removed in the washing and riffling operations which follow.

The rubber scrap as it comes from the defiberizing department is ready to be manufactured into high grade

PEQUANOC RECLAIMS

The quality, cleanliness and uniformity of which have been recognized standards in the Rubber Industry for forty years.

PEQUANOC RUBBER CO.

QUALITY RECLAIMS FOR SPECIFIC PURPOSES

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Toronto, Ontario, Canada

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189 Regent Street
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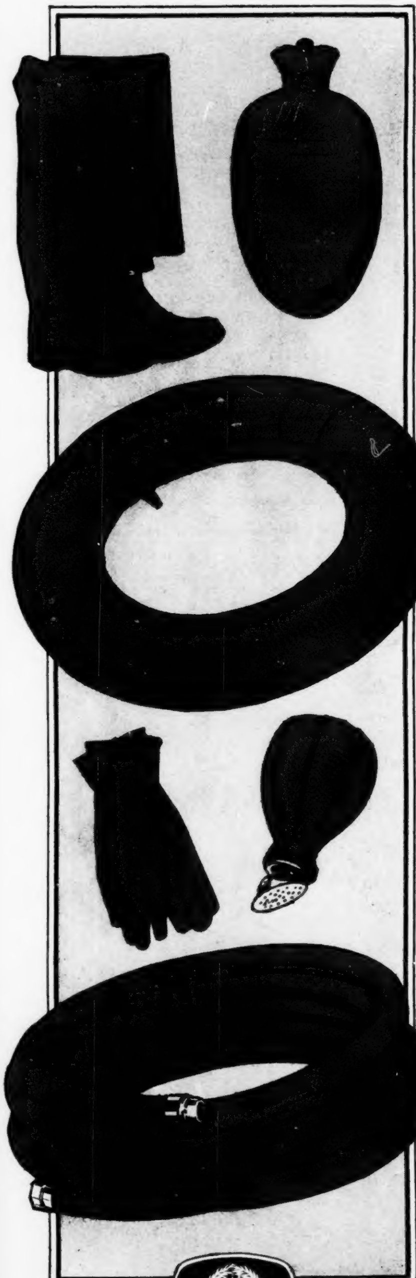
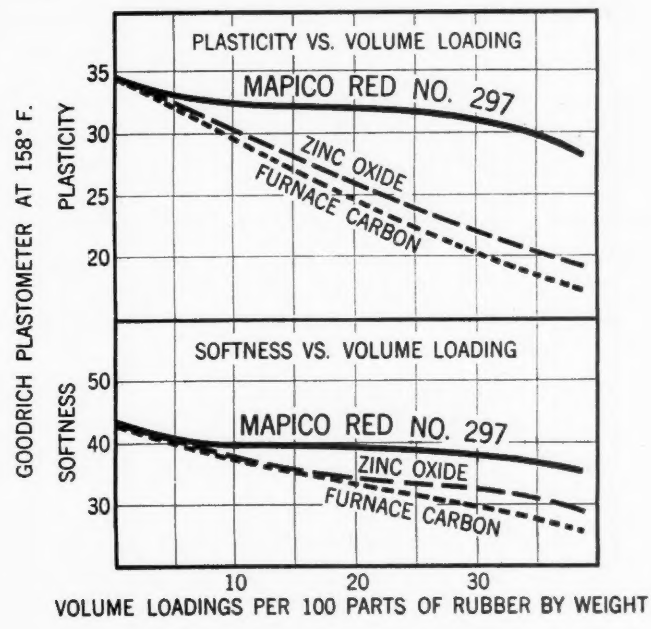
New IN PROCESSING PROPERTIES . . .



MAPICO RED No. 297
FOR RUBBER COMPOUNDING

TUBES AND CALENDERS EASILY

Mapico Red No. 297 can be loaded into a compound up to 30 volumes on the rubber (over 150 parts by weight) and still process easily. (See graphs.)



USE MAPICO RED No. 297 FOR . . .

1. Good aging behavior
2. Moderate reinforcement
3. Tear and flex resistance
4. Easy processing

MAPICO NO. 297 RED RUBBER IS GOOD RUBBER

DIVISION OF COLUMBIAN CARBON COMPANY

NETIC PIGMENT CO.

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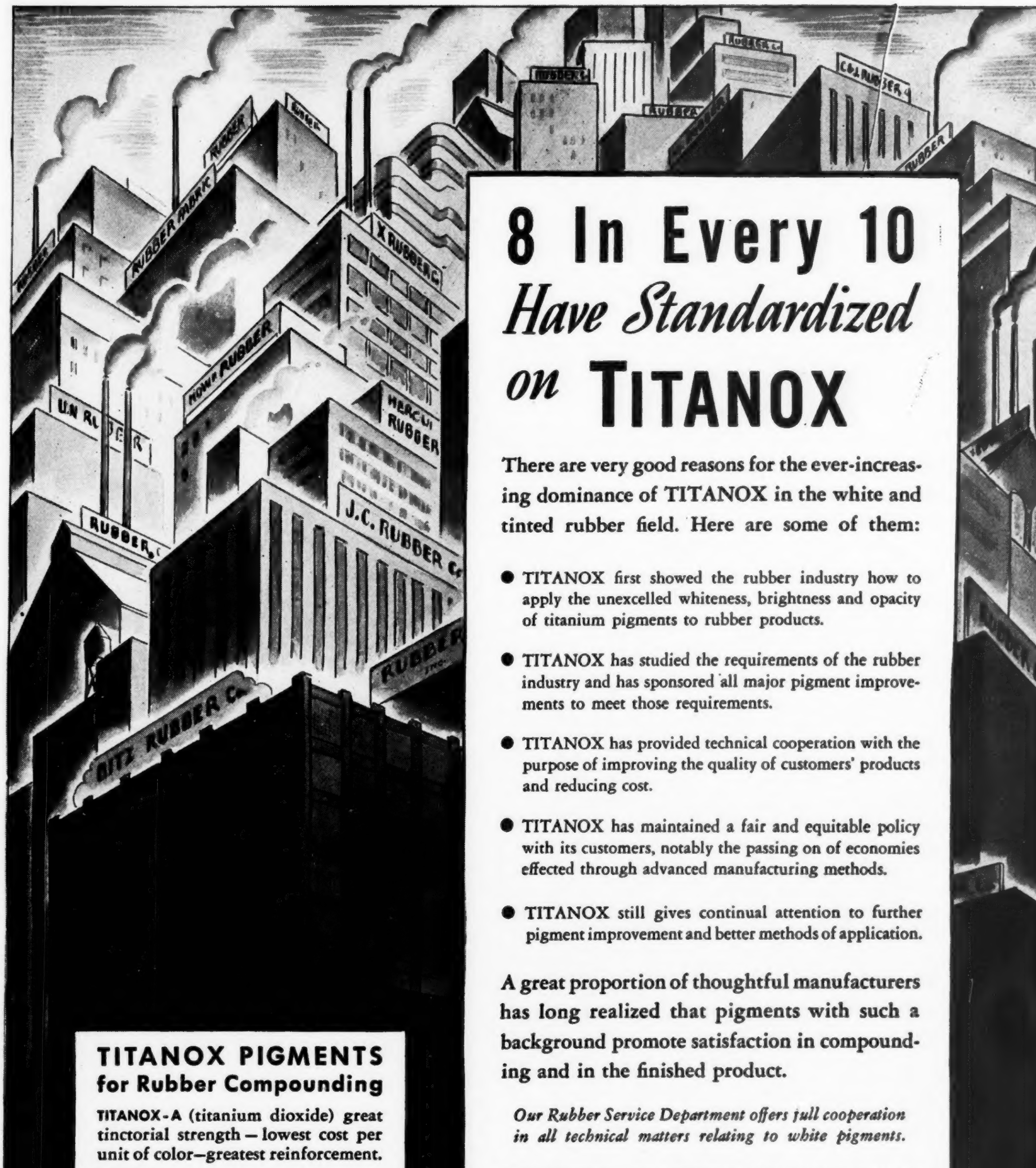
8 In Every 10
Have Standardized
on TITANOX
There are very good reasons for the ever-increasing dominance of TITANOX in the white and tinted rubber field. Here are some of them:
● TITANOX first showed the rubber industry how to apply the unexcelled whiteness, brightness and opacity of titanium pigments to rubber products.
● TITANOX has studied the requirements of the rubber industry and has sponsored all major pigment improvements to meet those requirements.
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A great proportion of thoughtful manufacturers has long realized that pigments with such a background promote satisfaction in compounding and in the finished product.
Our Rubber Service Department offers full cooperation in all technical matters relating to white pigments.
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TITANOX PIGMENTS for Rubber Compounding
TITANOX-A (titanium dioxide) great tinctorial strength — lowest cost per unit of color—greatest reinforcement.
TITANOX-C (titanium calcium pigment) low volume cost for whiteness and brightness—superior in reinforcing to ordinary fillers.
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TITANOX
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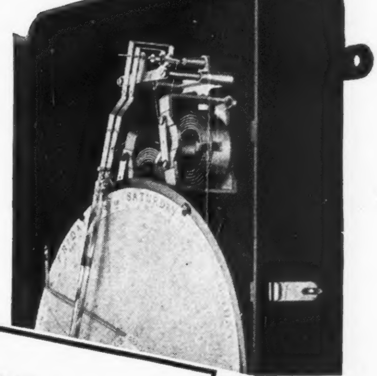
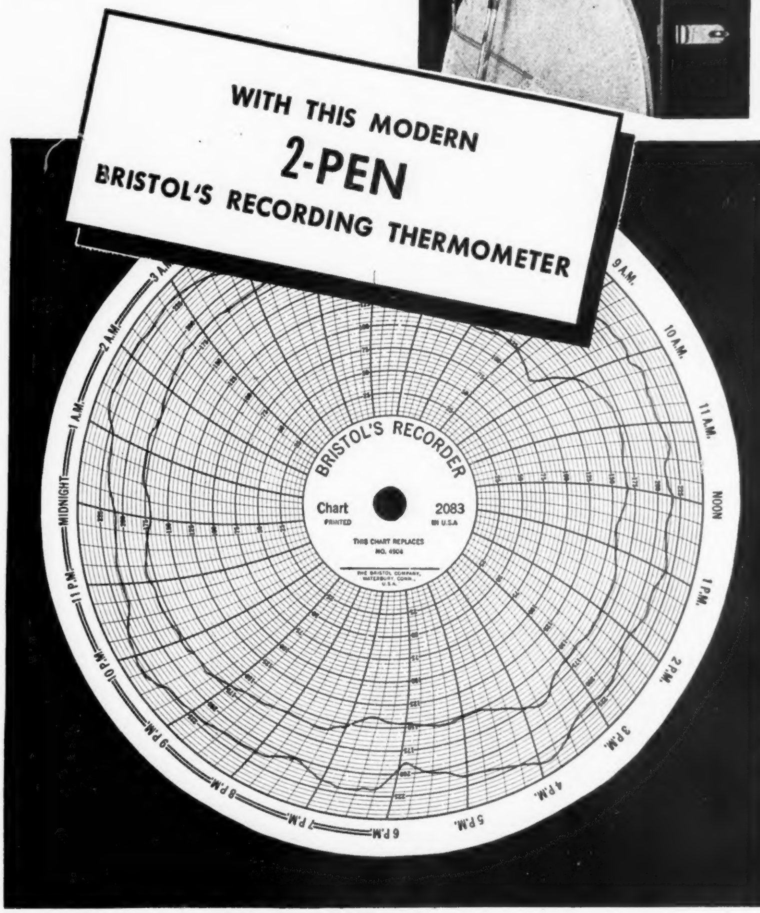
TRADE MARK

2 TEMPERATURES

on one chart!

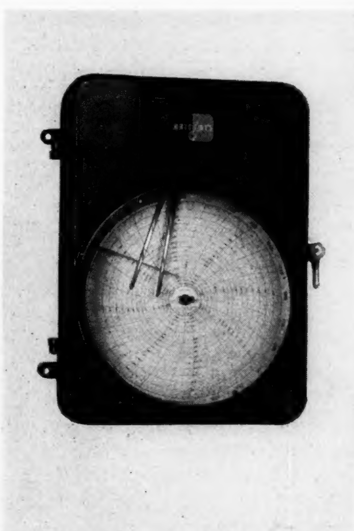




PERHAPS YOU, too, have often wanted a running comparison of two different temperatures on one chart,—because you wanted to compare these temperatures and their relative fluctuations from moment to moment.

With Bristol's Two-Pen Recording Thermometer, you have a visual picture of two simultaneous temperatures . . . continuously recorded on one chart throughout the day and night.

For further information, particularly for further facts on how you can benefit from this modern Bristol's Recorder, now furnished in 1, 2, 3 and 4 pen models, write for Catalog 12-51B.



AIR-OPERATED FREE-VANE CONTROLLERS

Offered in recording and indicating models. All possess the fundamental principle of operation which makes Free-Vane Control outstanding in precision,—the motion of the control device is full-floating; it depends only on the change of the quantity under control. No retarding action on measuring element. A complete line of types and models for accommodating the lag, load and other characteristics of all your processes. Write for Catalog 40-50B.

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